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Illustrated by Five page Plates in Colours; Nine page Plates in Monochrome, and Nineteen text Illustrations.
(Including portraits of the late Sir Thomas and Lady Wardle.)

RAM SINGH DEL. MAYO SCHOOL OF ART LAHORE

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# Asian Carpet Designs

## By W. GRIGGS

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**A Crown (20 by 15 inches) Series of 150 plates, in 6 Parts, each containing 25 plates, superbly printed in colours, and enclosed in a strong ornamental Box Portfolio. Price £18 net.**

In this exhaustive work an endeavour has been made to cover the whole known field of early carpet manufacture. The text (by Colonel T. H. Hendley, C.I.E.) is decorated in a style worthy of the charming designs illustrated; each page being surrounded with a beautiful 16th century Persian border in eight colours and gold. His Highness the Maharaja of Jaipur, with his well-known liberality, readily consented to allow his collection of old Persian and other carpets to be photographed specially for this work. From these carpets full-size patterns of the details, in colour of originals, have been prepared by Jaipur artists, also large "keys" showing the planning of the details in forming the schemes of design. In all cases the designs are on a large scale suitable for technical work. The best carpets and rugs now in the Indian and Persian Sections of the Victoria and Albert Museum have been photographed, including the beautiful Ardabil carpet* (see press notice).

* This carpet measures 34 feet by 17 feet 6 inches, and contains about 380 hand-tied knots to the square inch, which gives over 32,500,000 knots to the whole carpet. One-fourth of the carpet has been photographically reduced to half scale of original, and has been printed in the colours of the original to form 10 double plates (30 by 20 inches), and may also be obtained flat for mounting on linen, about 8 feet 6 inches by 4 feet 4½ inches, for Museums, Schools, and other educational or industrial purposes. The price of this part, or separate set of plates 101-125, for framing, is £3 net.

### NOTE ON PERSIAN CARPETS. [*Daily Telegraph.*]

In the Indian section of the South Kensington Museum is now exhibited one of the most splendid examples of the product of the Persian loom that have ever been seen in Europe. This is the famous Ardabil or Ardebyl carpet, so-called from a Persian town in the province of Aderbaïdjan, which from time immemorial has been an emporium of merchandise, en route between Tiflis to Ispahan. Ardabil, which from the salubrity of its climate and the abundance of water which it enjoys has been called "the abode of felicity," is full of mosques and the tombs of exceptionally pious or otherwise renowned Mussalmans, and the famous carpet now on view is said to have been obtained from a mosque at Ardabil. It was not without difficulty that this wonderful piece of weaving was secured for South Kensington. The price demanded for it (£2,500)[1] exceeded that which the authorities of the Museum thought themselves justified to offer; but through the liberality of a number of gentlemen deeply interested in Oriental arts and crafts the sum which the Museum was prepared to give has been supplemented to an adequate amount. The carpet thus obtained for the nation measures 34 feet in length and 17 feet 6 inches in breadth, and an idea of the extreme fineness of its texture may be formed from the fact that it contains about 380 hand-tied knots to the square inch, which gives over 32,500,000 knots to the whole carpet. The main design comprises a large central medallion in pale yellow, surrounded by cartouches of various colours, disposed on a dark blue ground diapered with floral tracery. Each of the corners is filled with a section of a large medallion surrounded by cartouches. The border is composed of long and circular panels alternating with lobed outlines on a brown ground covered with floral embellishments, while at the summit of the carpet is a panel bearing a devout inscription tending to the inference that the carpet was originally used as a veil or curtain for a porch, and that it was the work of the slave "of the Holy Place, Maksoud, of Kashan, in the year of Hegira 946," corresponding with our A.D. 1540. Now, Kashan, on the high road between Teheran and Ispahan, was founded by Zobeide, the favourite wife of the Caliph Haroun-al-Raschid. It has been destroyed once or twice by earthquakes, but is at present a flourishing town adorned by a palace for the Shah, many large and beautiful mosques, and a number of caravanserais and public baths. At Kashan numerous manufactories of carpets, shawls, brocades, and silk fabrics are still carried on; but in 1540, when Maksoud, the slave of "the Holy Place," executed this marvellous work, admirable alike for its fineness of texture, its beauty of colour and symmetry of design, Kashan, with the rest of Persia, was under the sway of the Sophi dynasty, and the town is alleged to have contained no fewer than a hundred and fifty thousand inhabitants.

It is only within recent years that any very accurate knowledge of Oriental carpets has been disseminated in this country. The ordinary buyer knows three classes, and only three, which he roughly distinguishes as Turkey, Indian, and Persian carpets. The expert is, of course, a good deal more exact in his classification; but even his knowledge is as yet vague and confused. Carpets, either of cotton, silk, or wool, have during many centuries been used in the Orient, from the South of India to European Turkey, for domestic use, for the prostration of the praying Muslim, and for occasions of State. The carpets employed by the ancients are thought to have been of the nature of tapestry, and to have been chiefly used as loose coverings for couches rather than for floors. True carpets appear to have been early employed in Persia, and those called Turkish were no doubt originally of Persian manufacture, and were gradually exported and at length imitated in Turkey. Kernanshaw in Persia has still a carpet manufacture producing rich, soft, and beautiful goods, the sale of which adds considerably to the wealth of the province; while true Persian carpets are also made at Meshed in the Turkoman country and in Khorassan, and are justly renowned for the exquisite beauty of the patterns and the durability of the colours, which are purely vegetable dyes, comprising, among others, a green which is very difficult to make; it is conjectured to be a subtle combination of saffron and indigo. There is likewise a famous carpet manufacture carried on at Feraboun, near Teheran. The finest of all Persian carpets were formerly made at Herat, and one produced in the Chahal Minar at Ispahan largely exceeded in size the dimensions of the wonderful fabric at South Kensington, inasmuch as its length was a hundred and forty feet and its width seventy feet. The majority of these exceptionally vast and gorgeous products of the loom were destined either for the adornment of Royal palaces or the glorification of the holy Kaaba, or some scarcely less venerated shrine. Sometimes the entire interior of a mosque, such as that at Meshed Ali, was hung with superb carpets; and the Mihrab or niche towards Mecca was always a favourite object for such ornamentation. Mats or rugs of a much less costly nature were spread on the floors. With respect to the ordinary Oriental carpets, they may be roughly divided into two classes, the floral and the geometrical; and the former is the design affected by the higher and Aryan races, the last being preferred by the lower and Turanian races.

The beautiful Persian carpet at South Kensington may, it is to be hoped, become a most valuable factor in technical art education in this country. Some humourist once said of a Turkish carpet that its pattern resembled nothing visible in the heavens above or in the earth beneath, or in the waters under the earth; and, to a slight extent, this hyperbolical disparagement is justifiable in the case of the Turkoman carpets for which Vambery saw the old woman tracing the pattern in sand. The girls employed in carpet-weaving would obviously prick or chalk down on the particular piece of textile fabric assigned to them so much of the pattern as they were expected to weave, and these hasty sketches might in many cases deviate from the original model. Scores of workers were often employed in as many cottages in making these detached portions, which, when sewn together, may have presented a slightly mixed appearance, the incongruity of which was at the same time happily modified by the predominant traditions of design and colour which had come down to the people from remote ages. The pattern of the Ardabil carpet seems to be one perfectly distinct and regular, and, even did it present some slight obscurities, the puzzle could be easily cleared up by a careful and minute analysis and dissection of the whole work by the aid of practical geometry and conventional botany. It is curious to learn that, at the very period when Maksoud of Kashan, the slave of the "Holy Place," was completing the Ardabil carpet the manufacture of these commodities was first introduced into England by one William Sheldon, under the direct patronage of Henry VIII. The manufacture, nevertheless, was for many years exclusively confined to its use as tapestry or arras for the decoration of walls. The apartments of the palaces of Queen Elizabeth were hung with the costliest products of the Flemish looms, but her Majesty had certainly no carpets on the floors of her presence chambers or her banqueting halls. The floors were simply laid with rushes. The Oriental custom has always been and still is to employ carpets as hangings for shrines and porches, as coverlets for couches, and as rugs lying loose on the floor; and this sensible system, which has been largely adopted among us since the extension of the trade in Oriental rugs, will, in all probability, be still further developed by the technical as well as by the æsthetic teaching of the splendid carpet at South Kensington.

The Journal of Indian Art and Industry.

# THE SILK INDUSTRIES OF INDIA AND THE LIFE AND WORK OF SIR THOMAS WARDLE, J.P., F.C.S., F.G.S., &c.

The death of Sir Thomas Wardle of Leek affords an opportunity of once more drawing attention in the Journal to one of the most important and interesting Industries of India which no man, perhaps did more to promote and foster. The following are the principal articles of reference to the subject of "Silk" which have already appeared in it—No. 5. October 1884. "Thana Silks" is by Mr. B. A. Gupte, who states that the Industry is entirely confined to the Christian Community, numbering nearly 1,000 souls. Silks were made locally from A. D. 10 to 1260, and were probably brought from Persia and China. In 1583 there was a great traffic in Silk and Silk Cloths and in the sixteenth Century as many as 6,000 weavers were employed. The Industry was now much depressed. The special features of Thana Silks were of two classes, viz.—Silk with checked patterns which were, it appeared, of European origin, and others with graceful geometric and probably Saracenic designs. All the silk was bought raw in Bombay, and came chiefly from China, Bengal, Basra and Bokhara. The processes of weaving and dyeing are carefully described.

Good specimens of Kinkhab (*Kincob*) brocade, or cloth of gold, or silver, or both, and silk, were exhibited in the Bombay Court of the Colonial and Indian Exhibition of 1886. They came from Ahmedabad and Surat and were described in No. 11, the May Journal for that year.

In No. 15, Sir Thomas (then Mr.) Wardle, had an article on "The Indian Silk Culture Court," at the same Exhibition. He observed that in the previous year he was asked by the Government of India and the Royal Commission for the Colonial and Indian Exhibition to go out to India chiefly in the interest of Sericiculture in all its branches, which include the important and long established, but depressed Silk Industry of Bengal, the Tasar silk development of cocoons and raw silk, now happily a vigorous and settled European and American manufacturing industry which fifteen years ago was non-existent, and that of the other wild or semi-domesticated silks, such as the Eri, Muga, Atlas and Cricula trifenestrata, as well as others which are yet but little known to art or commerce in England. He was also to investigate the state of dyeing and printing fabrics in India; and to collect examples of Silks in all forms, for the Silk Culture Court of which he was the Honorary Superintendent, and of which he afterwards wrote his "Descriptive Catalogue," a work which he intended to be of permanent interest and reference. All these projects were successfully carried out as far as Sir Thomas was concerned.

He believed that there was a great future for Sericiculture in India and especially that the time would come "when the Silk manufacturing centres of Europe would desire the raw silks of Bengal as much as they now do those of China and Japan," because it was shewn that Bengal cocoons were capable of being reeled into raw silk of remarkable cleanness, regularity, fineness and elasticity.

Mr. Buck, (now Sir Edward) the Secretary to the Government of India, in the Revenue and Agricultural Department approved the suggestions of Mr. Wardle, for placing the Industry on a scientific basis. A Sericicultural laboratory was established at the Indian Museum, Calcutta, in which life studies of various species of Silkworms were conducted with a view to the production of the best cocoons, and therefore the amelioration of disease, breeding of the worms, growth of suitable food for them, and the introduction of better systems of reeling. Mr. Wardle, also gave an account of the manufactured and decorated silk of India which included the Corah (*Korah*) silks of Bengal, the coarse Tasar fabrics of the same and other districts, the magnificent Kinkhabs of Benares, Ahmedabad, Surat and Baroda, the plainer silks of Delhi, the delicate and beautiful silks of Thana, the ruder although not less interesting silks of Peshawar and the surrounding country, the satins of Azimgarh, Ahmedabad, Surat, Dhrangdhra and Kathiawar, the wonderfully constructed patterns of the Patolo weaving with "tie and dye" warp and woof, and the silks of Berhampur, Cambay, Cutch, Indore, Kathiawar and Bombay. These extensive but somewhat condensed extracts from the paper indicate the extreme wideness and interest of the Silk Industry and productions of India. The collection in the Silk Court was very comprehensive.

Much prominence was given to the embroidery of India which is on a great scale, to mixed fabrics such as the embroidered curtains of Dacca which were worked upon a cloth of cotton and Muga (*Antherœa Assama*) silk, to silk shawls from Burma and Pegu and to specimens from all the districts which have already been noted. He referred also to the indigenous methods of dyeing and to the dyes in use which he said were beautiful, and on which he subsequently prepared a valuable monograph. The Illustrations to the number are exceptionally fine.

No. 16, October 1886, Mr. B. A. Gupte, in describing the Baroda Court and its contents, refers to the Patolo silk, and suggests that the soil and climate of Baroda are well suited for the growth of Tasar silk and the nurture of the moths.

No. 18 of April 1887, is devoted to Embroidery by Mr. Gupte. He refers to the beautiful embroidery of Sindh on silk or cloth, and to the still better known work in silk and gold on scarves and the shawls of Kashmir as well as to cloths for which Delhi and the North of India are famous : to the use of so-called Dacca and floss silk and silver and gold wire in needle embroidery at Dacca ; and to Kalabattun or silk thread round which pure gold and silver wire, which is untarnishable, are twisted.

The Punjab silks and manufactures are described in several numbers. In Nos. 19, 20, 23 & 24, Vol. II., Mr. Kipling, in his review of the different districts, notes the gold and silk weaving of Multan and Bahawalpur, and similar belt weaving of Amritsar, the Kalâbattun of Delhi—the use of silk in embroidery at the same capital and elsewhere, the small manufacture, particularly of Lungis or turban cloths, at Jalandhar, and he refers to Mr. Coldstream's interesting investigations with the Tasar moth which demonstrate the ease with which an important staple might be added to the products of the Sub-Himalayan tracts. An unattractive lack-lustre silk fabric is made at Lahore from raw material imported from Kabul. Multan produces a less cottony-looking silk than the other Punjab products.

Mr. H. C. Cookson, C. S., writes in No. 24 a monograph on the silk industry of the same Province which had declined since the establishment of British rule. Silkworm-rearing had been carried on in a desultory way, however in Kangra, Hoshiarpur, and Gurdaspur, but the silkworm is supposed not to be indigenous to the Punjab, but to have been imported from Kashmir or Central Asia, though the raw material now came from Bengal, China and Bokhara, Amritsar being the great home of the trade,

We shall see later on how Sir T. Wardle, was mainly instrumental in developing and improving the Silk supply of Kashmir. The demand for silk was however much less than in Sikh times, cotton goods having driven the richer material out of the field. The European liking for Phulkaris or "flowering work" had however, given a temporary stimulus to silk embroidery which forms the subject in No. 24, of an interesting article by Mrs. F. A. Steel, who observes that the ancient art was essentially a diapering and not a flowering in silk.

Mr. Havell in No. 27, who mentions that silk carpets were formally made at Tanjore and other adjacent places, refers to some beautiful satins which are manufactured at Ayyampet, Arcot, Walajánagar and at Ariyalur in the Trichinopoly district. Silk weaving and embroidery are also made in other places, but Madras on the whole does not appear to have much to do with silk.

Babu Nitya Gopal Mukerji, wrote on the Silk Industries of Murshedabad in No. 38 of April, 1892. He lamented the decay of the Industry which he attributed to the ignorance and poverty of the weavers ; to decline in taste and want of patronage ; and to decline in the Hindu religion which led to a diminution in the use of Berhampur silk, for it appears that the inland trade in it mainly rested upon the requirements of the Hindu ceremonial rites in which pure silk garments are needed.

The principal centres for silk manufacture in the district were Berhampur, Mirzapur, Khagra and Islampur, Babu Mukerji describes a large number of different fabrics, and the colors used in dyeing, as well as the processes of weaving and manufacture generally, in much detail.

In No. 59 of July, 1897, Babu N. N. Banerjee, the Assistant Director of Land Records and Agriculture in Bengal, wrote at length on the subject of Dyes and Dyeing in Bengal. He was very pessimistic as regards the silk dyeing industry in Bankura, Midnapore, Rajshahi, Bogra, Bhagalpur, and even in Murshedabad, all of which were Bengal districts, which he stated was now quite moribund owing to the decline in the Silk Industry itself; indeed dyeing of all kinds had fallen off.

In No. 81, of January 1903, there are three articles on the silk fabrics respectively of the Bombay Presidency by Mr. S. M. Edwards, I.C.S., of the Central Provinces by Mr. F. Dewar, I.C.S., and of the Punjab, by Mr. W. M. Hailey, C.S. Mr. Edwards observes that to the Bombay Presidency the silkworm to-day is a complete stranger though attempts to rear it have been made in past years. The raw silk comes from China, Bengal, Persia and Bangalore. He describes the sorting, reeling and spinning, bleaching and dyeing, with the dyes ; warping and weaving and the finished fabric ; and illustrates his paper with an interesting series of drawings.

Mr. Dewar notes a similar condition of things to Bombay as prevailing in the Central Provinces. So far the mulberry Silkworm has not established itself but cloths and ornamental borders have for many years been made from imported silk from which he infers that an Industry has existed for at least one century, and probably for two in Berhampur and Nagpur.

The supply of raw material comes from China viâ Bombay and from Bengal viâ Mirzapur—amounting in 1867-8 to 228,862 lbs., half of which was Bengal silk.

At Nagpur and some other places the silk is usually worked up into womens' *saris* or veils, or into silk fringes for *dhotis* (waist bands) and saris of cotton, which are distributed all over the Mahratta country.

Gold and silver wire are interwoven with silk into extremely ornamental fabrics, as scarves or mandils, at Burhampur. The silk population of Nagpur in 1901, was little less than 12,000, showing the most prosperous period of the Industry in recent times. Mr. Dewar's account of Tasar Silk is full and interesting. The worm is found in the jungles of almost every district. There is a fairly strong demand locally for Tasar products but Mr. Dewar thinks the Industry is decaying chiefly because the supply of cocoons is failing.

Mr. Hailey in his paper on Silk in the Punjab, shews that there are no 'Wild' silkworms in the province which are commonly recognised as those of chief economic value, but consistent efforts have been made to domesticate the Bombyx Mori, or Chinese silkworm, and the fact that its food, the mulberry, flourishes and the temperature of some parts of the country is favourable, led to the hope that success would follow. So far however the amount of silk rearing is small. Mr. Hailey, states that the quantity of imported raw silk shows a tendency to increase. He describes the process of manufacture, notes the seats of it, and remarks that embroidery is probably done in every district. He thinks that the increased use is due to a more general diffusion of wealth amongst people who do not object to use mixed fabrics and he does not consider the change to be unsatisfactory.

In No. 82, April 1903, Mr. J. P. Hardiman, I.C.S., writes on silk in Burma.

Three specimens of worms are alone of sufficient importance in regard to the supply of silk to be worth rearing, these are :—(1) The Bombyx Arracanensis, or a species of the Bombyx Mori. (2) The Cricula Trifenestrata or Mango Silkworm and (3) The Attacus Atlas (Linn) so well known for its great size. He describes the processes of manufacture but has no account of the uses to which the silk is put. His paper is illustrated by interesting pictures drawn by native artists, amongst which are representations of the fabrics.

The great importance of the Silk Industry to India is also proved by the fact that in Sir George Watt's Official Catalogue of Indian Art at Delhi in 1903, no fewer than 49 pages, viz: from 289 to 338, are entirely devoted to the subject; besides which there are many references to the use of the material such as under embroidery and mixed fabrics—and silk and cotton which are made chiefly for the use of Mohamedans who should not wear pur silk in ceremonials. All who wish to make a complete study of silk should study this catalogue and the accountse in the Imperial Dictionary.

Sir G. Watt has several references to the beauty of Sir T. Wardle's illustrations in the Journal of Indian Art.

Babu T. N. Mukharji, F.I.S., of the Indian Museum, Calcutta, in his "Art Manufactures of India" (1888), devotes 16 pages specially to silk and silk fabrics.

The following quotation from his book is of importance. "Under the East India Company, large quantities of Mulberry Silk were produced, chiefly in Bengal, and exported to Europe. The Industry gradually declined since the abolition of the Company's filatures; and only a few years ago it was in an extremely deplorable state, owing it is said, to the deterioration which Bengal silk has undergone in quality of late years. The Government of India were making strenuous efforts to revive the trade by removing the causes of its decline, and if it ever goes back to its former prosperous condition, India will have a lasting debt of gratitude to Mr. Thomas Wardle of Leek, Staffordshire, for the great exertions he has made in this direction."

## PERSONAL HISTORY OF SIR T. WARDLE.

Having given some idea of the nature of the subject, of which the present number of the Journal treats, we may devote a few columns to the history of the man, with whose name in recent days it has been so inseparably connected, and then go on in some detail to show the part he took in developing the Silk Industry in India.

The compiler of this account, for he can lay no claim to any other title in connection with it, began his friendship with Sir Thomas Wardle, when he met him in India for the first time in 1885, and has since then frequently visited him in his two homes in Staffordshire.

He has therefore had ample opportunities of seeing one whom he thinks all must regard as an excellent representative of the best type of the English Manufacturer and citizen.

He was not only a keen and successful business man, but a large-minded lover of his fellow men, who wished to extend to all the subjects of the King those advantages which he himself enjoyed. It was no mere business profit which induced him to devote so much time and money—often to his great personal loss—to the development of the Silk Industry at home and abroad. He saw and sympathised with the people of those large manufacturing districts of England which had suffered most acutely from the rapid decline of the Industry in England and its transfer under adverse conditions, to other countries, but he had equal regard for the losses which for various reasons, had fallen upon our fellow subjects in India in connection with the decay of the trade and craft in that country. He believed that India could give what England needed to the great benefit of both countries. He thought that, if scientific methods were brought to bear on the cultivation of the silkworm and the preparation of the silk in India, the Dominion could supply the greater part, if not all, the raw material which England required. Indeed he was so enthusiastic that he assured his friends that he believed the increased revenue and prosperity to be derived in India from a revived silk cultivation and industry would be sufficient to recoup the losses, which he foresaw, would follow the repeal of the regulations connected with the cultivation of Opium in that country.

His labours as President of the Silk Association of Great Britain will be adverted to later on, and it will be shewn that he did much to carry out his ideas in connection with the Industry in England. His even wider projects in relation to India form the principal reason for the publication of the present number of the Journal.

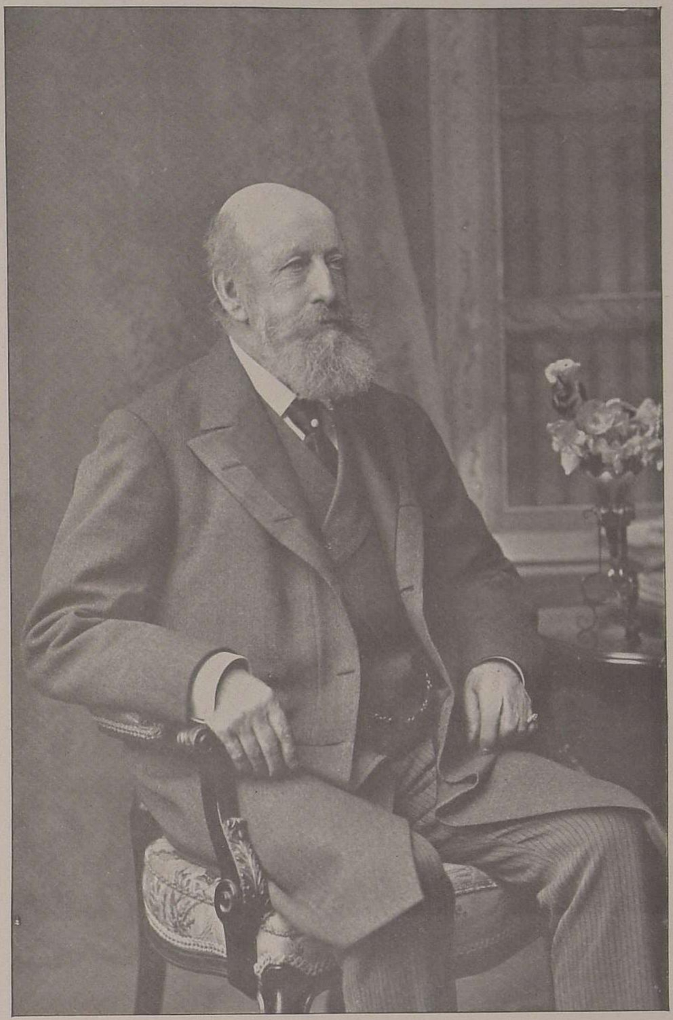
The brief Memoir which has been kindly written by his son, Mr. G. C. Wardle, narrates the principal events in his useful life, and also gives a short account of the work of Lady Wardle, who was equally enthusiastic, in the beautiful branch of Embroidery, in developing the uses of silk, and especially in making known in Europe the charm of Indian designs and their adaptability to various purposes both in the West and in the East.

The Memoir shows how a man who makes the very utmost of his own particular business in life can yet be keenly alive to many other interests and can serve his King and country in them all. Moreover we learn from it that Sir Thomas Wardle was a fine sportsman and a lover of all country pursuits, a good musician and a man holding strong views as to the greatness of the Empire, and the necessity of unity of all parts of it.

He collected almost everything, and every object he acquired was valued, and had peculiar interest to him. It is not wonderful then that he had many friends in his own neighbourhood as well as in all parts of the country and the empire which he had visited. His death has therefore left a gap which it will be difficult to fill, not only to his friends who recall the memory of one whom to have known was a real gain and pleasure but to many who only knew him by his works.

# MEMOIR OF SIR THOMAS WARDLE.

SIR THOMAS WARDLE, F.C.S., F.G.S., &c., and Justice of the Peace for Staffordshire, was born at Macclesfield on January 26th, 1831. He was the eldest son of Mr. Joshua Wardle of Cheddleton Heath near Leek who founded the Silk Dye Works of Joshua Wardle & Son, at Leek Brook, when Sir Thomas was scarcely a year old. Educated at Macclesfield and Leek he entered his father's business and his early energies soon bore fruit in the well-being of the firm. His efforts in life were not destined to be restricted to one particular channel, for soon after the death of his father he brought into being the Silk and Cotton printing business of Wardle & Co., at Hencroft, Leek, where most beautiful and artistic work in block printing was carried on. One of the most interesting features of Sir Thomas' life was his association with Mr. William Morris who encouraged him in the artistic side of his business career and with whom for many years he enjoyed the closest friendship. No doubt Morris was instrumental in stimulating Sir Thomas in the production of the earliest Morris prints on Cretonnes and Silk so well known in England; Morris on one of his visits to Leek actually worked at Hencroft works with his own hands to produce certain colours so suitable to his particular designs and Mr. J. O. Nicholson of Macclesfield, was entrusted with the weaving of the silk portion of these trials, some of which were dyed with pure Indigo from the vat. Later on Sir Thomas printed and dyed silk pieces for Mr. Liberty and finished them at his other works in Leek, (Churnet Works) and in the perfecting of this branch he was ably assisted by his son Mr. A. H. Wardle.



The most wonderful trait in Sir Thomas' character was the work he managed to get through apart from his real business, for he found spare moments when work was done to enrich his mind in many other matters. He was a keen student of Chemistry, Geology and Archæology and later on of Sericiculture, and his tastes ranged over an even wider field. Looking on his lighter side he was fond of music, more especially Church music, and his love for it dates back to his earliest days and from the time when he trained the Cheddleton Choir and played the Organ in that Church. He was always closely drawn to the Church especially in relation to music and adornment, and it is not too much to suppose that the study of Archæology and also stained glass was responsible to some extent for creating associations and friendship that so much influenced his later life.

In the year 1857 he married Elizabeth, daughter of Hugh Wardle of Leek, and in her he possessed one of the best of women, always ready to aid in times of need and with a power of organization not often met with. Lady Wardle was practical in a high degree and was a truly fitting helpmate. She was gifted with an artistic temperament and consequently was able to render her husband much help through life in the artistic part of his business. It was on account of her love for artistic needlework and their united interest in the Church that they together founded the Leek School of Embroidery where most tasteful and original work in both design and colour was done; the designs on Tasar Silk fabrics, the wild Silk of India, and the subsequent embroidering with the Tasar Silk threads, producing exceedingly rich and artistic work. Lady Wardle died on the 8th Dec., 1902. The late Vicar of Leek, the Rev. T. H. B. Fearon, speaks of her in a sermon following her death as follows :—"She sought and very largely found perfection in the art of sacred embroidery and lavished it upon the Church. I said that the heavenly life would be an active and a busy life. That is just what her earthly life was." Perhaps one of her most notable achievements was the reproduction (a perfect copy) of the celebrated Bayeux tapestry, embroidered scenes and figures upon cloth, and in this she was assisted by many ladies of Leek and district. The work now helps to adorn the Art Gallery and Museum at Reading.

The first dealing Sir Thomas had with Indian products was the trial he made, at the instigation of Sir George Birdwood, to utilize Tasar silk, the wild silk of India, and to make it a marketable commodity. As a result of his experiments he succeeded in bleaching the brown fibre and in dyeing it with such perfection, as to make it serviceable in the manufacture of fabrics. He tried the effect of Tasar as a pile fabric, and in 1872 he had a piece of Tasar plush woven in Crefeld. The idea was speedily taken up in Yorkshire and an article was manufactured successfully in that county under the name of Seal-cloth. For several years a Wardle collection of bleached and dyed Tasar silks was on exhibition at Lyons and Sir Thomas soon came into close association with the principal users of silk in France, and the results of his experiments in overcoming the difficulty of bleaching and dyeing this stubborn silk were, at the request of H.R.H. The Prince of Wales (now King Edward VII), exhibited in the British section of the 1878 Paris Exhibition, of which His Royal Highness was President. Sir Thomas became a juror at this International Exhibition and had the honour to be appointed a Chevalier of the Legion of Honour.

At the instigation of Sir George Birdwood, the Secretary of State in the year 1885 sent Sir Thomas Wardle out to India in order to make a typical collection of silk textiles and native embroideries for the Silk Culture Court of the Colonial and Indian Exhibition, and he was also requested to visit the Bengal silk districts and to make a report on Sericiculture. Bengal silks at that time did not enjoy a very good character, for they had fallen into a low state from one cause and another. Sir Thomas read his report before Sir E. C. Buck and the leading merchants in Calcutta on January 8th, 1886, and as an outcome of the enquiry it was brought to light that 60 % of the silkworms died of preventable diseases and that the reeling from the cocoons in the filatures was very imperfect. It was on account of this finding that Sir Thomas recommended the sending of an educated Indian to the Government stations of Sericiculture in both Italy and France, in order to learn all that was necessary to ameliorate the conditions of things in Bengal. This trip to India proved to be one of lasting interest and pleasure to Mr. Wardle as he then was; he revelled in the Indian atmosphere, the manners and customs of the people charmed him, everything was so vastly different from the life he had been accustomed to and the climate did much to give him a new lease of life, for his health and strength at that period were not of the best.

In the year 1887 Sir Thomas accepted the position of Chairman to the Silk Section of the Manchester Jubilee Exhibition and, chiefly through his energies, a display of silk manufacturing processes from the reeling of cocoons onwards was exhibited. It was from this exhibition that the Silk Association of Great Britain and Ireland came into existence with Mr. Wardle as its president, and to this honorable post he was elected, without intermission, year after year, until his death in 1909.

It must not be supposed that Sir Thomas was a man of such means that he could afford to neglect his home affairs with impunity, and had it not been for his brother's assistance in many matters of business it would have been impossible for him to have spared the necessary time for his country.

During the year 1896 Lieut. Colonel Sir Adelbert Talbot, K.C.I.E., was appointed resident in Kashmir, and, as a result of his study of Sir Thomas' encouraging reports on the possibilities of Kashmir silks, he recommended H. H. The Maharaja of Kashmir to commence the Industry on a commercial basis and in a scientific and extensive manner. In 1897 Sir Thomas was requested to consult with Sir George Birdwood at the India Office on the subject, and subsequently he was sent to France and Italy to select the best races of silkworm eggs, and to acquire the very best reeling machinery as well as to find a suitable person to direct operations in Kashmir. Mr. C. B. Walton was appointed to this post and materially helped in carrying the undertaking to so

successful an issue. Sir Thomas always advocated that new eggs annually imported from Europe were vastly more beneficial to Kashmir than "Eggs of reproduction" from Kashmir, as it was quite impossible for the village Kashmiris to understand the use of the microscope in detecting pebrinised moths and eggs, and the various minutiœ of this special branch of the Industry are so completely understood and taught under the direction of the Government experts in Italy and France.

In the year 1897, at the instance of Lord Salisbury, he received from Her Majesty the Queen, the honour of Knighthood for the work he had given to India and the Silk Industry generally.

From the year 1897 the Sericiculture in Kashmir progressed and went ahead by leaps and bounds and in 1900 the output of Raw Silk was 57,921 lbs; in 1901 it increased to 90,648 lbs, and in 1902 it reached the very creditable figure of 135,221 lbs It was in 1903 that Sir Thomas again visited India and a Durbar was held in March of that year at the Palace of Jammu to welcome him and to hear what he had to say as to the method of the distribution of the raw silks in Europe. His Highness the Maharajah and his brother the late Sir Amar Singh were both present at this Durbar and listened with interest to Sir Thomas' impressions of his stay in the reeling districts of the South of France. Samples were shewn of raw silks of the French reeling and also some magnificent figured brocades woven by Messrs. Warner & Sons, of Spitalfields, made entirely from Kashmir silks. The Maharajah was pleased to acquiese in the suggestion that a piece should be presented to H.M. The Queen of England and another to H.R.H. The Princess of Wales, and Sir Thomas was asked to be the bearer of them. The mission was formed in due course and to quote his own words. "It was impossible not to be struck with the genuine satisfaction and pleasure evinced both by the Queen and the Princess of Wales on the reception of these beautiful silks."

At a conference held later Sir Thomas strongly advocated the commencement of silk weaving in the State and he was instructed, with the Maharaja's sanction, to send out from England the plant necessary for an initial factory, and the first instalment was 200 looms together with a young and capable weaver from Macclesfield to superintend the preliminary stages. Success proved to be in the wake of this venture and at the present time scientific weaving takes place daily at Srinagar.

Before coming to the conclusion of this biography it is necessary to refer to the many kindnesses met with by Sir Thomas when in Kashmir. The many friendships he had the pleasure of making, and the kind treatment he had the honour of receiving at the hands of H.H. The Maharajah of Jammu and Kashmir and his brother General Raja Sir Amar Singh, were never forgotten.

The Times says "Sir Thomas' most conspicuous service for his country was the work he did in helping to revive the Silk Culture Industry in the Valley of Kashmir. The Industry was of ancient standing but had fallen into decay, and it is not too much to say that had not Sir Walter Lawrence taken up this matter in his capacity as Settlement Officer of the State, the fate of the Sericiculture would have been sealed, consequently it was upon Sir George Birdwood's initiative that Sir Thomas Wardle went out to Kashmir as expert adviser to the Durbar. How innumerable difficulties were overcome and how a moribund Industry was placed upon a footing of prosperity is told in detail in Sir Thomas Wardle's "Kashmir and its new Silk Industry" (1904), in which he was able to state that Sericiculture, besides giving employment to large numbers of villagers in the "Happy Valley" brought the State Durbar a revenue of £90,000 to £100,000 a year."

One of the most important honours, and certainly the one that gave Sir Thomas one of his greatest pleasures in life, was his admission by the Worshipful Company of Weavers to the honorary freedom of the Weavers' Company on Feb. 3rd, 1903. The Certificate of admission was presented with a casket bearing the arms of this ancient institution and the motto "Weave truth with trust." He was then able to acquire the Freedom of the City of London and the two certificates now lie safely in the casket and we trust will long remain an heirloom in his family.

Sir Thomas wrote many monographs on the scientific and technical subjects that interested him. He added a learned chapter in the Geology of Leek and district to the first edition of the "History of Leek" by John Sleigh, published in the year 1862. His splendid collection of carboniferous limestone fossils he gave to the Nicholson Institute at Leek. Other works on Geology were:—"Geology of the Roches," Geology of Shuttlingslowe," "Geology of Mid-England." He also wrote on the technical aspects of artistic weaving and his monograph on "The present development of Silk power-loom weaving in France" was the outcome of a visit to Lyons in 1893 to investigate the subject. His works on Silk and the Silk Industry were most numerous the most important being "Report on the English Silk Industry," "Silk, its Entomology History and Manufacture," "History and growing utilizations of Tasar Silk," "The Wild Silks of India," "The Dyes and Tans of India," "The adulteration of Silk by Chemical weighting," "Kashmir, its new Silk Industry," Etc., and his last work was a monograph on the Divisibility of Silk Fibre published in 1908.

Perhaps the most pleasing duty is to emphasize his home life and one cannot do better than quote the words of John Bickerdyke, which appeared in the "Field" newspaper. January 9th, 1909.

"It was at his country house at Swainsley, which is built on a low buff among the dales of Staffordshire, sloping down to the river Manifold, that my friend was seen at his best. Here was a hall crammed full of trophies from India including a huge Bengal Tiger; here were reminences of Scotch fishing expeditions, a rack of many fly rods, drawers full of flies, a room devoted to chemical and microscopic work and a fine organ, the bellows of which—and this was characteristic of the man—were blown by water-power elevated from the Manifold by means of a hydraulic ram." "Days at Swainsley are joyful memories."

The above is endorsed by the editor who adds:—"The feelings of regret and admiration expressed by "John Bickerdyke" will be echoed by a wide circle of friends and acquaintances and his faithful sketches of life at Swainsley will bring many a happy memory to those with whom Sir Thomas Wardle was always delighted to share his sport."

Sir Thomas Wardle died peacefully at his Leek residence on January 3rd. last, in his 78th year, surviving his wife by seven years. He always lived a life of high pressure, he worked well, and played well, and it was doubtless in consequence of this judicious combination of the two that he was enabled to live a life of almost youthful activity. It was only six months from his death that the strain perceptibly told on him, and from that period he gradually sank and passed away. He was laid to rest in the pretty churchyard of Cheddleton and many old friends were present to pay their last tribute.

An account is appended of the origin, objects and work of the Silk Association of Great Britain and Ireland, together with an interesting memorandum compiled by Sir Thomas himself, setting out the steps taken by him to further the development of the Silk Industry in Kashmir and India.

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## FORMATION OF THE SILK ASSOCIATION OF GREAT BRITAIN AND IRELAND.

On the 21st October, 1887, in the Silk Section of the Royal Jubilee Exhibition, Manchester, a Conference was held for the promotion of the Silk Industries of the United Kingdom.

Sir Thomas (then Mr.) Wardle, Chairman of the Silk Section, presided, and among others present were Sir Joseph Lee, Sir W. Cunliffe-Brooks, Mr. W. Bromley-Davenport, M.P., and Mr. (now Sir Alfred) Bateman, of the Board of Trade. Sir J. Lee, in welcoming the Delegates to the Conference, said he ventured to hope that their deliberations might result in the formation of a Guild or Association for the purpose of stimulating a revival of the Silk Industry in the country. This idea originated with Lord Stanley of Preston (afterwards Lord Derby) who was at the time President of the Board of Trade, and who said:—"We feel very much at the Board of Trade that we need some central organization which would make us in touch with the Silk Industry of this country, for we know very well that our returns are very imperfect; we want instructing a good deal; we have much to tell such an Association, and we hope that one of the principal resolutions of this Conference in Manchester will be the appointment of a Silk Association."

His Lordship sent down Mr. A. E. Bateman of the Board of Trade to attend the Conference, who was much interested in the proceedings, and he framed the resolution which was passed and which was the birth of the Silk Association of Great Britain and Ireland.

The objects of the Association were formulated, and were as follows:—

(*a*) The promotion and maintenance of the Silk Industry of Great Britain and Ireland in all its branches.

(*b*) To encourage the production of Raw Silk in India and our Colonies.

(*c*) To collect and disseminate amongst its Members, useful information and statistics connected with or affecting manufacture and commerce in Silk

(*d*) To promote Technical, Commercial and Linguistic Education, and any necessary Parliamentary legislation and generally to assist in the expansion and development of the Trade.

(*e*) To do all such other lawful things as are incidental or conducive to the attainment of the above objects or any of them.

The Membership of the Association included Silk Manufacturers Merchants, Dyers and Finishers and others who were interested in promoting the welfare of the Silk Industry.

Sir Thomas Wardle was appointed President in 1887 at the Silk Conference, an office which he held uninterruptedly up to the time of his death. The Secretary, Mr. A. E. Piggott of Manchester, was also appointed at the same time and he still retains that office.

Council Meetings were fixed to be held twice a year in Manchester and the Annual Meeting and Dinner were always held in London in February during the time of the Silk Sales.

The Association issued Annual Reports of work done, and these contain some very interesting information.

The following notes touch on the main features of the work of the Silk Association since its formation :—

At the first General Meeting of Members held in London in 1888 it was thought that the most important lever to raise the efforts to success was to secure the preference of British and Irish ladies for silks of home manufacture, instead of going to the Continent for their requirements.

The outcome of this was the formation of the Ladies National Silk Association, and the first president was H.R.H. Princess Mary Adelaide, Duchess of Teck. On her death, the office of president was taken by her daughter, H.R.H. The Princess of Wales, who still holds that position.

Silk Exhibitions were held under the auspices of the Ladies' National Silk Association in 1890, at Lord Egerton's House, St. James's Square, London; in 1894 at Stafford House, London, by permission of the Duke of Sutherland; in 1895 at Stafford, and in 1900 at Earl's Court, all of which helped to draw the attention of the public to the fact that silks for dress and upholstery purposes could be as well, if not better, produced by British and Irish manufacturers, as by those of the Continent.

Technical Instruction in silk was also taken the greatest possible interest in by the Silk Association, and it was largely owing to the efforts of the Association that the important Municipal School of Technology was founded in Manchester.

Beneficial action was also taken with regard to the regulation of Railway Rates and Charges and also with regard to foreign Tariffs.

The reorganization of Sericiculture in Cyprus was one result of the Association's work, through the Colonial Secretary in 1890, when the President made an exhaustive report on Cyprus silks.

The energies of the Association were applied, and with success in obtaining for British manufacturers contracts for silk goods given out by the Admiralty and the War Office and also in enlisting Government sympathy in a proposed amendment of the Carriers' Act which unfairly burdens the carriage of silk goods.

In 1901 H.R.H. The Prince of Wales consented to become patron of the Association.

French Silk Duties.—In 1905 the Silk Association took steps with regard to the proposed increased tariff by the French Senate on silks entering France, which would, if adopted, have seriously affected the silk trade of this country, particularly the manufacturers of silk crape who did a large export trade with France. With the co-operation of the British Chamber of Commerce in Paris, and the Associated Chambers of Commerce of the United Kingdom, whose Conference at Liege in September, 1905, Sir Thomas Wardle attended on behalf of the Association; the appeal was successful, and the tariff remained as before.

Sir Thomas is succeeded in the Office of President of the Silk Association by Mr. Joseph Boden, of Messrs. Kidd, Boden & Co., Manchester.

In addition to the useful purpose served by the Association of organizing the Silk Industry so that it can officially consult with and receive information from Government Departments and kindred Societies here and abroad, bringing influence to bear in various directions when the interests of the Industry are affected, it has also provided a means or inter-communication and combination between its members which did not previously exist and must operate for the advantage of all.

# ON SERICICULTURE AND SILK WEAVING IN KASHMIR AND INDIA.

BY THE LATE SIR THOMAS WARDLE, F.C.S.; F.G.S., J.P.

*28th October, 1907.*

The possibility of systematic Sericiculture, or the production of Raw-Silk, in Kashmir was first suggested by me to the Government of India in 1891. I recommended to the Under Secretary of State for India that inasmuch as the Mulberry tree was not only indigenous but abundant in Kashmir, and that I considered the climate of Kashmir extremely favourable for the cultivation of the Silkworm, it would be of great importance to commence Sericicultural operations there on a sound basis, such as is so successfully and scientifically practised in Italy and France, and I predicted that it was very probable in a short time a large and remunerative Silk Industry might result.

It was especially necessary for me to emphasise this recommendation at that time because famine and disease were rife in Kashmir, and many people were dying for want of food and remunerative employment.

I stated to the Government of India that I had a deep conviction that the future of the Silk Industry would be of great importance, and that if the Maharaja of Kashmir thought favourably of the idea and would give it the necessary encouragement, Kashmir might become one of the most important centres of Sericiculture, and I asked for the co-operation of the Government of India in the matter.

The result of this recommendation was that the Government of India warmly took up the suggestion.

I visited the Government Schools of Padua in Italy, and Montpellier in France, where all that relates to the breeding and rearing of the Silkworm, the cultivation of the Mulberry and the reeling of cocoons, are taught on the most practical and scientific basis.

Experimental work was carried on in Kashmir in 1894, and about 8 lbs. of raw-silk were produced and sent over to England, which I caused to be manufactured into brocade by Messrs. Warner & Sons, Silk Manufacturers of Spitalfields.

The brocades were exhibited at the National Silk Textile Exhibition held at Stafford House, the London residence of the Duke of Sutherland. These were the first fabrics made of Silk produced in Kashmir.

In July 1895, some further samples of Kashmir raw-silk were brought over to London on behalf of the Kashmir Durbar, and were sent to me for a report as to quality, etc.

I reported on the 5th December, 1895, and advised that the stock of raw-silk should be shipped direct to London.

16 Cases were despatched, and these were received in London on the 26th January, 1896.

During the year 1896 Lieut-Colonel Sir Adelbert Talbot, K.C.I.E., was appointed Resident in Kashmir, and as a result of his study of my encouraging reports on the possibilities of Kashmir Silk, he recommended H.H. the Maharaja of Kashmir to commence the Industry on a commercial scale, and in a scientific and extensive manner.

The Kashmir State Council accepted Sir Adelbert Talbot's advice, and the Government of India was addressed accordingly.

The result was that in February 1897, I received a communication from the Under Secretary of State for India with reference to the further development of Sericiculture in Kashmir, and I was requested to have a consultation with Sir George Birdwood at the India Office on the subject.

The outcome of this was that I was sent by the Government of India in June, 1897, to the South of France and Italy to select the best races of silkworm eggs, to purchase the best machinery for reeling cocoons, and also to endeavour to find a suitable person (either a Frenchman or an Italian) who could direct Sericicultural operations in Kashmir. I endeavoured to find such a person, but was not able to do so, and I reported to the India Office that I preferred to decline the responsibility of engaging either a Frenchman or an Italian, chiefly because none of them understood either English or Hindustani, and also that I was not personally acquainted with any likely persons; but I recommended instead Mr. C. B. Walton, who had for twenty years occupied important expert positions at the Surdah Silk Filature in Bengal, and who was familiar with the language. He was at the time open to engagement, having retired from the Directorship of the Bengal Filatures, and the Under Secretary of State for India requested me to telegraph to him at once to go up to Srinagar to see Sir Adelbert Talbot, on whose advice the Kashmir Durbar gave him the appointment. The selection was a very fortunate one, for much of the marvellous success which has since attended Kashmir Sericiculture was due to his untiring labours.

During my visit to France and Italy in 1897, I purchased upwards of £600 worth of Silkworm eggs, and these, together with the cocoon reeling machines I bought in Italy were duly sent out to Kashmir. The hatching of the eggs and the rearing of the worms were most successful, and I was requested to purchase £1,500 worth for the ensuing season.

I did so, and the following year, 1899, £3,040 worth were purchased. In 1900 orders arrived for £4,000 worth, and in 1901 the same quantity was again ordered. Mr. Walton gave out the seed to 6,000 householders and they farmed it out, and altogether more than 25,000 people, young and old. were employed in rearing the crop of silkworms throughout the Valley of Kashmir. Thus the production of the Silk there is essentially a Cottage Industry as far as silkworm-rearing goes; but the reeling of the cocoons is entirely done in the factories in Srinagar, by Srinagar workman and boys, in the six new Filature Factories which were erected under Sir Adelbert Talbot's able supervision. Two Hibernation houses were also constructed, a necessary and important feature for the success of the Industry, as the silkworm eggs are there kept at a low temperature until the leaves of the Mulberry are ready for consumption by the worms,

I have always recommended the Government of India to adhere steadfastly to the purchasing of undiseased eggs from Europe, notwithstanding advice to the contrary by those who thought that "Eggs of reproduction" in Kashmir would do as well. Silkworm breeding and rearing in Europe is a very scientific Industry, and it was impossible to expect the village Kashmiris to understand the use of the microscope in detecting pebrinised moths and eggs, or in the various minutiæ of this branch of the Industry which is so completely understood and so skilfully taught under the direction and supervision of the Government experts of Italy and France.

But nearly every year since 1897, however, at my request, eggs of native reproduction have been tried experimentally in Kashmir on a small scale, and have always, through want of scientific oversight, failed. In 1904, the then Resident, Mr. Colvin, told me that it had been decided that the danger of using tainted seed could not be over estimated.

It will be seen how completely I was justified in making what was considered at the time, over adventurous purchases of eggs.

The value of the eggs ordered in 1902 was £4,084, and the same in 1903; in 1904, £4,960 worth was ordered; in 1905, £4,240 worth, and £3,840 worth in 1906; and a similar quantity this year. I am glad to be able to state that in each of these years the yield of cocoons has been most favourable and successful.

When Mr. Walton was appointed Director of Sericiculture in 1897, the out-turn of raw silk from the Kashmir State was for the preceding year only 10 to 12 maunds (820 to 984 lbs). In 1898 he had the first European seed purchased by me in Italy and France, in 1897, to work upon, and in 1899 the profit to the Kashmir State on the Sericicultural operations was £13,333. The raw silk sent to England in 1889-1900 was about 150 bales, or 22,500 lbs. which found purchasers at 16s. 9d. per lb.

Owing to the more trained manipulative skill on the part of the new cocoon-reelers, the quality of the raw silk was beginning to approximate to that of Italy and France, and would consequently command a higher price. In 1902 Mr. Walton sent over to England 953 maunds (74,186 lbs.) besides sending 100 maunds (8,200 lbs.) to the local markets for local use.

In 1900 I arranged a second exhibition of Kashmir raw and woven silks in the Silk Section of the Woman's Exhibition at Earl's Court, which was most successful and drew attention to this newly established Industry.

In 1903 I determined to go out to Kashmir to see how Sericicultural matters were going on. The Government of India approved of my going, and on the 13th March, 1903, a Durbar was held in the Palace at Jammu to welcome me, and to hear what I had to say on the various subjects connected with the silk Industry in Kashmir, and on the mode of distribution of raw-silk in Europe.

No balance sheet had been compiled for the years 1900-1903, so at my request the Accountant-General had one drawn up, which showed that there was the handsome profit to the State of £40,240 on the three years' working.

In May 1903, a Sericicultural Conference was held just before my return to England, and at that Conference I strongly advocated the commencement of Silk Weaving in the State, as I did not see why the natives there should not be taught how to weave such fine silks as are so largely imported into Europe and America from China and Japan; and in addition to that there was also the great field of silk-wearing India, with an extensive and important market close at hand. The Maharaja said he thought it was an excellent suggestion and that he should be very glad to see Silk Weaving introduced, as up to that time no Silk-weaving existed there.

On my return home I therefore got out plans for an initial factory and had 200 looms made and sent out. I also selected a young Macclesfield weaver as Superintendent of silk weaving. This branch is now well established, and should under good management, prove a successful one, and this I firmly believe will be the case. The Director has taught a number of Kashmiris to weave, and silk cloths similar to those exported from Japan to Europe are now beginning to be sent over in the grey for sale in London.

Mr. C. B. Walton, continued the Directorship of Sericiculture in Kashmir until September 1904, when he was invalided home, and to the great regret of all who knew him, he died on reaching England. Fortunately, he had left his son-in-law, Mr. Douglas, as Assistant Director during his absence, and he was appointed to succeed Mr. Walton as Director; this post he is in every way competent to fill, and still holds, directing the Industry very ably and successfully

The profit for the working of the Sericicultural Department for the year 1904 was £20,963, for 1905-6 £30,500 and will prove to be considerably more for 1907 and will again be substantially increased in out-put for 1907-8.

The crop of cocoons for 1907 is a record one, being no less than 28,000 maunds, equal to 1,100 tons.

The following table shows the gradual increase in the production of raw silk :—

| | | |
|---|---|---|
| Out-turn of Raw Silk for 1900 | 57,921 | lbs. |
| ,, ,, ,, 1901 | 90,648 | ,, |
| ,, ,, ,, 1902 | 135,221 | ,, |
| ,, ,, ,, 1903 | 146,087 | ,, |
| ,, ,, ,, 1904 | 132,451 | ,, |
| ,, ,, ,, 1905 | 152,425 | ,, |
| ,, ,, ,, 1906 | 190,736 | ,, |

There are now 10 large Reeling Factories at Srinagar, the capital of Kashmir. Each employs 560 men and boys in reeling cocoons. The number of Bassines, or reeling-basins is over 1,000, a most gratifying progress which has every promise of annual increase.

The number of village householders who now take out silkworm eggs is 15,784, and as their wives and children are occupied in feeding the silkworms and attending to the details of silkworm-rearing, their number, supposing four persons in each family assist in this industry, may be roughly estimated at between 60,000 and 70,000 persons in this new and remunerative industry.

A Sericicultural Branch has also been opened at Jammu under the Directorship of Mr. Fakir Chand, within the last few months.

At the Franco-British Exhibition, London, in 1908, the Kashmir Government sent a most effective Exhibit of cocoons, raw silk and woven silks. The Jury, in making their Awards, evinced much interest in these products and awarded the Grand Prix to the Kashmir Government for the Exhibit, together with a Gold Medal for the Director of Sericiculture and a Silver Medal for the Assistant Director.

## THE BENGAL SILK INDUSTRY.

I will now turn to the Silk Industry of another part of India for the purpose of comparison with that of Kashmir.

In the years 1885-6 I was sent out to India by the Government to report on the Silk Industry of Bengal, which was then in an unsatisfactory and decadent condition. Since the time of the East India Company, this Industry had been a very important one in extensive districts of which Surdah and Berhampur were then central points.

I reported to the Government of India that I found upwards of 60 °/ₒ of the silkworms died of disease before making their cocoons, owing to want of scientific knowledge and management. I recommended the engagement of some person who should first come to Europe to study the Sericicultural methods of France and Italy, and then for an Imperial Government Institution to be established there, where every branch of scientific Sericiculture could be conducted and taught to the Natives; in fact a Government Silk School, either in Calcutta or other likely centre, with highly qualified Teachers to instruct them how to prevent disease, to annually improve the races of silkworms and the growth of the mulberry.

A young Brahmin, Nitya Gopal Mukerji, was sent over to Europe by Sir E. C. Buck, Secretary to the Revenue and Agricultural Department, and he studied first at Padua, then at Montpellier, and lastly at Paris under Pasteur, who had succeeded in stamping out the pebrine and other silkworm diseases which had devastated for a time the magnaneries* of France and Italy.

* Places for rearing silkworms (French).

Nitya Gopal Mukerji returned to Bengal and was appointed to undertake the work of scientific Instructor This arrangement was commenced and continued for a time, when, owing to difficulties and disagreements with his Committee, his instruction and work unfortunately ceased.

It was a pity and a mistake that an Englishman had not been technically educated for the duty. From that time to the present Sericiculture in Bengal has gone from bad to worse, until at the present moment the Industry is stated to be in a moribund condition.

It is sad to think that a valuable Industry extending, at its best period, over hundreds of square miles in Bengal, of which Berhampur was the centre, should have fallen into such a deplorable condition.

All the causes which have led to this are strictly preventable by, first, the proper growing of the best kind of mulberry leaves. In Europe the white mulberry produces the best silk; in Bengal the Morus indica is used, but the botanical aspect should be well and continuously studied as is the case in the Government Sericicultural establishments for Italy at Padua, and for France at Montpellier. Secondly, thoroughly scientific rearing of the silkworm and the constant use of the microscope in the examination of all the female moths set aside for breeding purposes, and the absolute elimination and destruction of all eggs laid by those moths in which the pebrine corpuscle has been found.

Thirdly; absolute cleanliness, ventilation of the magnaneries with thoroughly applied disinfectants, and regulation of temperature to prevent destruction by heat or cold waves.

4th, a study of race culture of moths so as to obtain the largest and best cocoons.

5th; the purchase of eggs from districts set apart for breeding purposes, and away from the feeding and rearing centres.

This plan has admirably and abundantly succeeded in Kashmir, and there has been no failure since the system was inaugurated by myself, of buying eggs guaranteed free from disease, from Europe.

It would be of no avail in Bengal to purchase eggs from Europe as is the case in Kashmir, because the silkworms of Bengal are of a different and bivoltine species, namely, Bombyx fortunatus and Bombyx craesi, whilst those of Europe are the Bombyx mori which are suitable to the climate of Kashmir and not to the more tropical climate of Bengal.

In short, what is imperatively needed for Bengal Sericiculture is the adoption of European procedure in its entirety, the central idea of which is a Sericicultural Station strictly under the control of the Imperial Government as in France and Italy, and by no means under a local committee, with their ever-varying and conflicting ideas. It is a melancholy fact that what the committee is now aiming at might easily have been successfully accomplished 21 years ago, and the industry saved if my recommendations had been carried out.

These remarks apply equally to several other species of silkworms found in Southern India, such as Bombyx sinensis, Bombyx textor and Bombyx meridionalis, where extensive Sericicultural districts could be laid out for Silk production.

By way of contrast I now turn to another part of India where Sericiculture, now absent, could have enormous introduction and expansion.

On the 13th October, 1906, I wrote to the Government of India to suggest that as the mulberry was indigenous in many Valleys of the Punjab Terai, and as the Natives were in some parts destroying the trees and replacing them with other and more useful fruit trees, the subject of Sericiculture should be added to the Syllabus of Punjab Agriculture. I believe it has been, or is about to be, inserted.

That a similar development to that of Kashmir can be instituted successfully, but upon a vastly more extensive scale, I have not the slightest doubt whatever, and that European silk of the Bombyx mori can be cultivated not only in the Punjab but in the Terais of the regions east, west and north of the Punjab.

In Baluchistan it is already successfully established, although in a more experimental way. I have been consulted from time to time by Major Showers when he was Political Agent in Kalat, and since his departure from there by Major Rae Benn, who succeeded him.

## TASAR SILK.

As is well known my study has been given to the production of Tasar Silk in India.

In 1878 the Prince of Wales (now King Edward VII.) President of the British Section of the Paris Exhibition of that year, had his attention drawn by Sir Philip Cunliffe-Owen to my researches on the dyeing and utilization of that wild Silk. H.R.H., requested me to exhibit my results in the Indian Section of that Exhibition. I did so, and as a Member of the Silk Jury, I had a good opportunity of directing the attention of the Lyons Members of that Jury to my discoveries in dyeing and printing this hitherto intractable Silk tinctorially, also in weaving it into various articles of commercial importance, principally plush.

The Lyons Manufacturers told me that they could see their way to a gradual utilization of this Silk. At that time none was used in Lyons or in Europe, but its usefulness was gradually increased and it is at the present time a most important and valuable European and American Industry.

The average amount during the last few months of Tasar raw silk conditioned weekly in Lyons is upwards of 300 bales (40,500 lbs.)

Now, unhappily, notwithstanding that the Tasar Silkworm is found nearly over the whole of India, the European demand has found its supply from China instead of from India, and I earnestly urge that adequate steps be taken to promote and increase the production of this silk in India.

The fashion in Europe has set in for cloths called Shantungs, which are made of Tasar silk, and many thousand pieces of native woven goods are being quarterly imported into Europe from China.

The results of my utilizations of Tasar silk are fully described and illustrated in my "Wild Silks of India" published in 1881 by the Lords of the Committee of Council on Education.

I visited the Tasar silk reeling districts of Chota Nagpur, Gya, Fatwah, and other Gangetic centres in 1886, and found several Industrial Tasar Silk centres, with women reeling the cocoons.

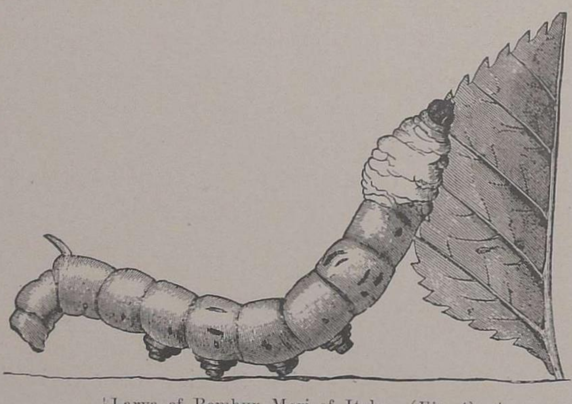
I read a paper on the subject on the 17th May, 1891 at the Society of Arts, London, when the late Lady Egerton of Tatton was in the Chair. In May 1895 I also read another paper at the Society of Arts on Silk when H.R.H. the late Duchess of Teck presided.

Owing to the want of energetic steps the Indian branch of this new important Industry has been almost non-progressive, whilst in China it has increased by leaps and bounds, both in the production of the raw-silk thread for weaving in Europe, and also in native woven Shantung cloth, the demand for which at the present time is very much greater than the Chinese supply, and therefore offers a great opportunity to India which ought to be vigorously taken hold of by capable oversight.

I have recently been informed by Mr. Rogers that there is a possibility of a successful culture of the Tasar Silkworm in the province of Gujarat, and also to the north of the Gulf of Cambay, and even as far as Rajputana. It would appear that the Presidency of Bombay is worth serious attention for the production of Tasar Silk.

Should it prove to be so, the labours of Colonel Coussmaker at Poona will not have been in vain. *

Sir Thomas Wardle has himself described in several publications the principal species of larvæ which produce silk. In a paper on Tasar silk which he read before the Society of Arts on May 14th, 1891, he states that "It is but a few years ago that it was thought there were only one or two kinds of silk, but in the Silk Culture Court of the Colonial and Indian Exhibition, upwards of 59 species of silk-producing worms were shewn with the silk they produced," and in the silk section of the Manchester Jubilee Exhibition he was able to show no fewer than 265 species of moths whose larvæ make cocoons. He showed how "all the species have the same instinctive object in covering themselves with this silken envelope, namely to protect themselves during that wonderful and all but lifeless pupa or chrysalide state, which in the mysterious arrangement of their lives, they have for a time to undergo. It is this silken chamber, which in the case of the Bombyx Mori, has for so many centuries been wound off into a continuous thread, dyed and woven into fabrics of such great charm, variety and utility in India and the further East." Sir Thomas thus briefly sums up the natural history of every kind of silk—"From a small egg laid by the moth, of whatever species, appears in due season a small larva or caterpillar, or worm, as it is usually called. This worm, after having lived its day, feeding only on the leaves of certain plants characteristic of its species, and increasing in size, spins or rather secretes, a fine silk thread for itself for covering and protection during the time it lies dormant in the next stage of its existence. As soon as it has secreted all the silk it changes into a pupa or chrysalis and remains inside its silken cell until the time for its appearance as an imago or perfect moth, having four scaly wings, six legs and two antennæ, which are larger in the male than in the female. When its hybernation is ended it emits a fluid which softens



½ Larva of Bombyx Mori of Italy. (*Fig.* 4) †

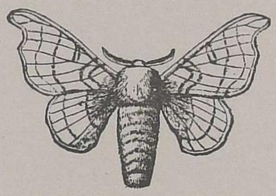
Cocoon of Bombyx Mori, Italian. (*Fig.* 16)

* Some of the information given in this section has been anticipated in the earlier part of the Monograph, but it is thought better not to curtail Sir Thomas Wardle's own note.

† NOTE.—The numbers of the figures on this, and also the following pages, are taken from Sir T. Wardle's Work on the "History and growing utilizations of Tasar Silk," 1891.

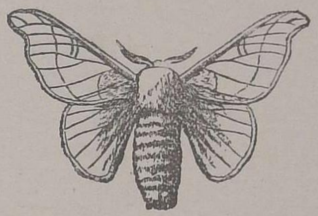
the end of its cocoon cell, and by means of its wing-spines and legs, parts the fibres aside until the opening is large enough for it to creep out—after a short time its wings expand and dry, and it enters into its perfect state. It lives only a few days in this phase of its existence. It is in this stage only that the race is perpetuated, the female laying a number of eggs, and dying soon afterward." It is unnecessary in the present article to repeat in detail the information given by Sir Thomas Wardle. It will suffice to quote enough to explain the illustrations which have been reproduced by permission of his family from the original blocks which were used by himself—and first to describe briefly the ordinary silkworm of commerce, the Bombyx Mori, and then the principal ones in India, viz :- The Attacus Ricini or Eria worm ; the Attacus Atlas or Atlas worm ; the Antherœa Assama or Muga Worm ; and the Antherœa Mylitta or Tasar worm, with some reference to the A. Pernyi or Chinese Tasar worm.

The silk producing insects belong to the order Lepidoptera and are all members of but two families, viz :- the Bombycidæ and Saturniidæ. All the latter are silk spinners, but not all the former. The Lepidopterous insects form order X of sub-class III. Metabola ; class VIII. Insecta ; sub-division II. Anthropoda (or true Articulata) : Division III. Articulata in the great system of classification of the Animal Kingdom.



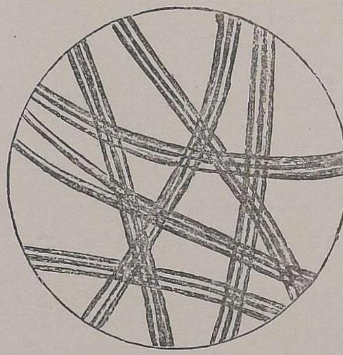
Bombyx Mori, or Mulberry feeding Silkworm (male). (*Fig.* 1)

Bombyx Mori, (Linnæus) the common silkworm domesticated in China, Bokhara, Afghanistan, Kashmir, Persia, South Russia, Turkey, Egypt and Algeria, Italy, France and Spain, in all which countries it produces but one crop annually, spinning the largest cocoon, and the best silk of a golden yellow or white. The silk which is generally known as the silk of commerce, in both ancient and modern days, is distinguished from all others by the singular circumstance of the larvæ which produce it being fed only on the leaves of the Mulberry tree.

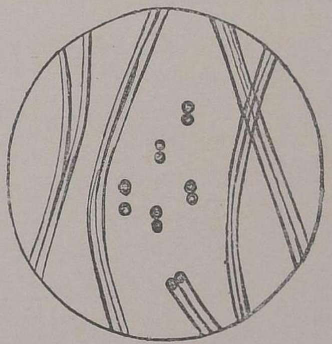


Bombyx Mori of Italy (male). (*Fig.* 2)

The breaking strength of a single fibre of Bombyx Mori (one 2,100th part of an inch thick in the mori silk of Italy) $2\frac{3}{8}$ drams against 7 drams in the case of Tasar silk. The fibre is round and homogeneous and resembles a glass rod, that being the characteristic and structureless form of the silk of all the Bombycidæ, whereas the family Saturniidæ produce silk of another structure. He observes that in all the Saturniidæ known to him the fibre is always more or less flat especially in Tasar silk, and possesses a structure not unlike the appearance of the warp-thread stretched in a loom before being woven. The width of this single or ultimate fibre of Tasar silk is about the 750th part of an inch, and in this narrow width there are about 20 smaller fibres or fibrillæ lying longitudinally and connected with each other by a hardened fluid seriposited at the time the worm forms this silken thread. The fibrillæ of the Chinese Tasar fibres are finer and rather more numerous than the Indian Tasar fibres. The value of the eggs of Bombyx Mori is about twenty-five shillings per ounce. Twelve pounds of cocoons are required to produce one pound of silk, and the value of the raw silk of Bengal in London is now (1881) from fourteen shillings to eighteen shillings per pound.



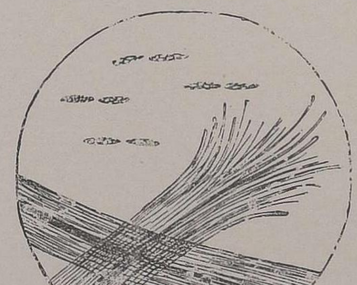
Fibres of Silk of Commerce, Bombyx Mori. (*Fig.* 11)



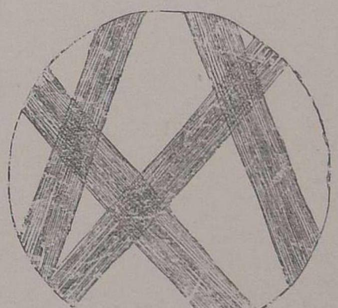
Silk of Bombyx Mori of Commerce, showing also transverse sections. (*Fig.* 12)

Attacus Ricini or Eria Worm.—The Eria silkworm feeds chiefly on the Palma Christi or Castor Oil plant (Ricinus Communis). It is a native of Assam and is also found in Nepal, Ladok, Chittagong, Puri, Gaya, Dinajpur, Rangpur, and perhaps in parts of Bhagalpur and Parnaih. In Assam it spins a white silk, whilst in Dinajpur the colour of the cocoon is brown.

The most complete account is probably the one written by Mr. Geoghegan, in his report on the Silk Industry of India.



Silk of Antherœa Mylitta, or Tasar Silk, showing separated fibrillæ and transverse sections. (*Fig.* 14)



Silk of Antherœa Pernyi, or Chinese Tasar Silk. (*Fig.* 15)

The following are a few statements made in regard to it. The female moth lays her eggs round a twig and then dies; these twigs are sold in the markets covered with eggs. The caterpillar moults four times and when fully grown is about $3\frac{1}{2}''$ long. It gives sometimes twelve broods of silk a year. It is difficult to reel, but the silk is better adapted for spinning. Mr. Lister (now Lord Masham) informed Sir T. Wardle, that Eria and Muga silk were to his mind far before Tasar. The former wrote "Abandon all ideas of reeling Eria silk, the cocoon is too soft, and the fibres mingled together too irregularly to afford any hope of successful reeling commercially. Produce it on a large scale, comb and spin it, and the success is complete." The cloth is described to be of incredible durability. The thickness of the fibre is one $1500^{th}$ part of an inch on the outside of the cocoon and one $1450^{th}$ in the inner part.

Dyeing Eria silk however is costly; whether owing to the flatness of its fibre or to the nature of its sericin (the gum or grès which encases the fibre as a varnish to preserve and protect it) it is far behind Mulberry silk in its natural affinity for dye stuffs, requiring about twice as much dye stuff as Mulberry silk. Sir Thomas Wardle was the first to impart a variety of colours to Eria silk which left nothing to be desired.

Attacus Atlas.—The imago or perfect moth of this species is the largest of all the silk moths. The largest specimens measure upward of $10''$ in expanse of wing. It feeds on the Phyllanthus Emblica, the Falconeria insignia, Bradleia ovata, and other plants (in Mussoorie), the Barberry (in Kumaon) the Soom tree (Sarcostemma brevistigma) etc., and is a wide spread species, ranging over the South and East half of Asia, continentāl and insular, common on the slopes of the Himalayas, and all through India to the points of both peninsulas, etc., (P. H. Gosse in the Entomologist 1879) "It is interesting to observe the Micaceous or window-like spots on each of the four wings. These, although characteristic of the Saturniidæ, are almost more largely developed in the Attacus Atlas, than in any other species. The diameter of the external fibres of the cocoon is very variable, averaging about one $1320^{th}$ part of an inch; whilst that of the internal fibres is more uniform and about $1000^{th}$ part of inch. The outer fibres can support an average weight of $2\frac{1}{8}$ drams, and the inner $2\frac{1}{2}$ drams. The fibres are flat and longitudinally striated and united in pairs by the edges. The larvæ moult six times. The cocoon is from 2 to 3 inches long and about 1 inch wide at the widest part and weighes about one $14^{th}$ of an ounce.

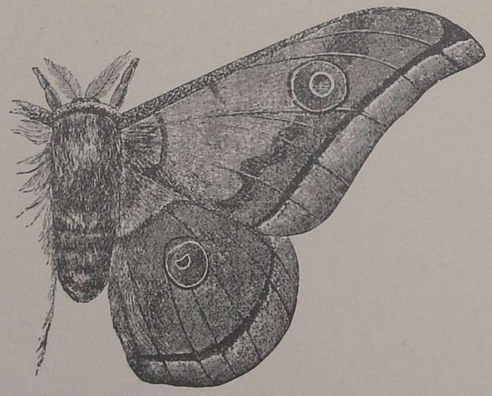
The cocoons are not closed like those of the Bombyx Mori or of the Antherœa, in consequence of which the exit of the imago leaves no disturbance behind. Mr. Geoghegan says the silk is difficult to reel. It is reputed to be decidedly good.

Antherœa Assama or Muga or Munga.—The worm feeds upon the Champa (Michelia, s.p.) the Soom (Sarcostemma brevistigma), the Tetranthœa diglottica; Laurus obtusifolia and the Tet. Macrophylla.

It is extensively cultivated by the natives, it can be reared in houses, but thrives best in the open air and upon the trees; it is found in Assam, and sparingly in the Dehra Dun, and is next in importance to Tasar.

The worm gives five broods a year, and the cocoon is very large but thin, the cycle of the insect is 66 days. The diameter of the fibres from the external part of the cocoon averages one $1,430^{th}$ part of inch, and from the inner, which is less variable, one $1,080^{th}$ part of inch. The outer fibres break with a weight of $2\frac{1}{8}$ drams, and the inner will support 3 drams. The staple produce from the Muga cocoon is excellent. The cocoon is larger and firmer than that of the Eria and can be reeled without difficulty. The silk is much better to dye than either Tasar or Eria, and it is done at a less cost. The spinning qualities (according to Messrs. Clayton Marsden & Co.,) of Eria and Muga are quite equal to any of the wild silks from China.

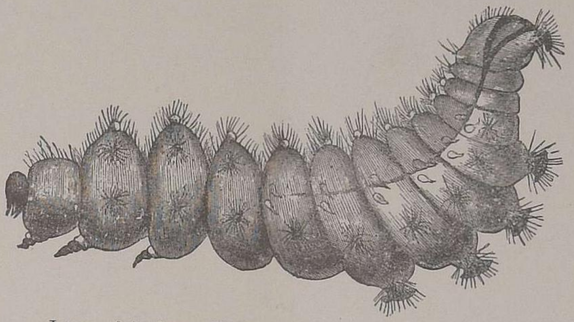
Antherœa Mylitta, Tasar.—The well known and valuable insects of this class (of various undetermined species) are widely distributed over India from East to West and North to South, on the coast and in the Central Provinces. They feed in a wild state upon the Ber (Zizyphus jujuba), the Asun (Terminalia Alata), the Semul (Bombax heptaphyllum, etc. This is the most important Indian wild silk. It has been utilised for many centuries both in India and China. The larvæ when fully grown, are about four inches in length; they have twelve joints or articulations, besides their extremities; their colour is green resembling the leaves on which they feed; and they are marked



Antherœa Mylitta, or Tasar Moth, Male. (*Fig.* 1)

Antherœ Mylitta, or Tasar Moth, Female. (*Fig.* 2)

with reddish spots and a reddish yellow band running lengthways. Besides the trees above named they feed on many others which are well known, as the Teak (Tectona Grandis), the Sal (Shorea Robusta), Lagerstrœmia Indica, the Karinda (Carissa Carandas), the country Almond tree and the Castor Oil plant. In England they have even been fed on Oak leaves. The large number of plants on which they live accounts no doubt for their wide distribution. Birds and ants are the greatest enemies of the worms. The Caterpillars moult five times. The cocoons vary much in size, the largest being 2 inches long and 1¼ inches in diameter. The ordinary weight is 16 grains. As a rule there are two crops in a year. The cocoon is made of hard and impenetrable material. The fibre is almost flat and to this property no doubt Tasar owes its glossy or vitreous look. Sir T. Wardle thought that the lustre of the cloth woven from it was thereby enhanced.

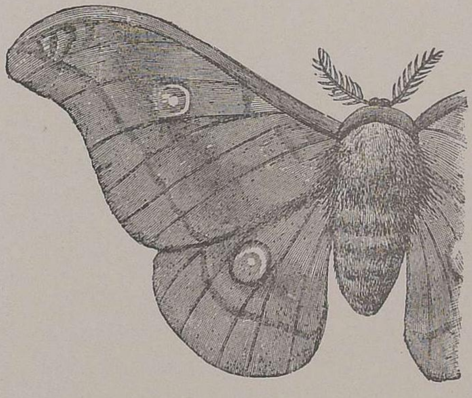


Larvæ of Antherœa Mylitta, or Tasar Silkworm. (*Fig.* 27)

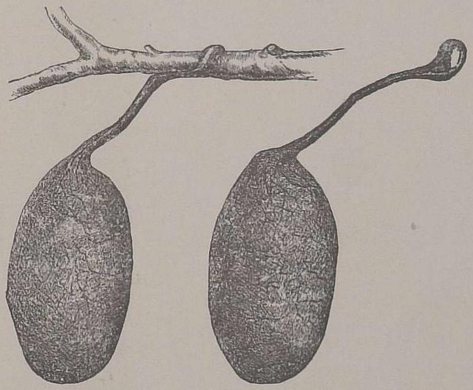
The diameter from edge to edge averages from the outer part of the cocoon one 770th part of an inch, and from deeper in the substance one 710th of an inch. The thickness from side to side is one 1,900th of an inch. The outside fibres can support an average weight of 7 drams and the inner, 8 drams. Like all other silk fibres, the fibres are laid in the cocoon by the silkworm in pairs, and are, like all flat silk fibres, united by their edges and not by their flat surfaces.

On May 14th, 1891, Sir T. Wardle read a paper (already referred to) on the history and growing utilizations of Tasar (Tussur) silk before the Society of Arts, in which he not only gave a full account of the silk itself, but he incidentally showed the great improvement and development of the Industry which followed upon his original researches and suggestions. It is desirable to condense some part of this account here.

There are two kinds of Tasar silk known to commerce, one Indian and the other Chinese, and in order to give as clear and complete account as possible, Sir Thomas Wardle spoke of both kinds. The Chinese moth (Antherœa Pernyi) has like the Indian moth four transparent wing spots, but they are much smaller and are not so transparent. The former differs from the latter much in appearance and colour. The Chinese worm is more insignificant than the Indian one, and it feeds on the Oak, there is much difference also between the cocoons.



Antherœa Pernyi, Male. (*Fig.* 3)

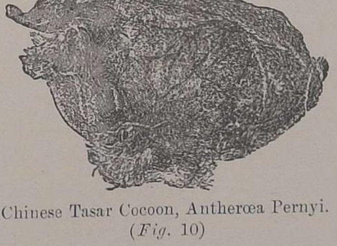


Tasar Cocoons with their Pedicals, showing natural attachment to branches. (*Fig.* 8)

Shows Cocoon cut open with Chrysalis inside. (*Fig.* 9)

The Indian cocoons are hard, well formed and very compact. They possess peduncular attachments with rings at the ends by which they are fastened to a branch or twig, a very necessary provision of nature, as the Tasar chrysalis requires months for its sleep.

The Chinese cocoon is soft and generally formed between two or three leaves of the Oak trees on which the worm feeds. It weighs from 8 to 9 grains. Chinese Tasar silk contains more sericin than Indian Tasar, and has a lesser percentage of silk than the latter. The former is generally loaded with saline and dirty extraneous matter, and the latter is always cleaner.



Chinese Tasar Cocoon, Antherœa Pernyi. (*Fig.* 10)

From time immemorial great difficulties presented themselves, especially in India, in dyeing Tasar silk. Forty-five years ago (that is before 1891), the father of Sir T. Wardle, one of the best English dyers, tried to overcome them but only with very partial success. His son continued the study until at last, with increasing acquaintance with the properties and structure of the fibre as well as a fuller knowledge of chemistry which aided him in the better application of tinctorial matter by chemical agencies he was able first to make greys of various kinds; then red, blues, and greens of not

very brilliant tones succeeded, and afterwards good yellows, pale shades of blues, reds and tertiary hues were produced. As soon as he had overcome the difficulties of dyeing this silk in the ordinary colours of the period, for it was before the introduction of aniline dyes, he was asked by the Marquis of Salisbury, then Secretary of State for India, to teach the Indians how to dye native wove Tasar cloth which was then used by English and French as well as by Indian women in the undyed state. It was far more difficult to dye the silk in the piece than in the skeins.

In placing his services at the disposal of Lord Salisbury, he suggested the desirability of the use in India of Indian dyes as the country was so rich in vegetable tinctorial products.

In accordance with his wishes, instructions were issued for the collection of all the well-known dye stuffs in India, and in due course a most valuable supply was sent to him for examination and report. It took him with an assistant, more than seven years to examine the materials. The result of that investigation was the issue of a Blue book of eighty-two pages, entitled "The Dyes and Tans of India."

In connection with this laborious work he prepared 360 sheets, containing about 3,500 dyed samples, illustrating the tinctorial results of 181 kinds of Indian dye stuffs, which show the tinctorial properties of all dyes commonly used in India.

Sir T. Wardle lamented that the usefulness of the work was counteracted by the facts, that owing to insufficient expenditure upon it, it did not contain the method by which he succeeded in obtaining the beautiful colours inserted in the book, nor were patterns included in it.

He concludes his remarks on this subject with the following interesting passage :—

"Since that time, for all art work, I have chiefly used Indian dyes, from which I succeed in obtaining results in tone and permanence absolutely impossible with most of the artificial dyes, good as some of them are, and if the Government of India had followed up my arduous work further and in a prompt and thorough way, I am sure Europe would now have been doing a large business in dyes with India, for all their *bon teint* purposes, and the Indian dyers themselves would have been able to make themselves acquainted with superior methods at present unknown to them. The way in which indigo, for example, still asserts itself is a sufficient proof. But it is not too late. As taste improves, the weaker dyes are more disliked, and I would from this place urge the Government of India to make the work so successfully begun by Lord Salisbury, complete. The Hindoo and Mohomedan dyers still remain untaught in the application of chemical science to their art, and the European dyers remain unaware of the excellence of scores of, to them, unknown Indian dyes."

The enthusiasm of Sir Thomas Wardle has induced many, both officials and others to work in the same good cause, but the difficulties in the way of introducing new methods, especially in the East, are enormous, and it is to be feared that no amount of zeal, or of official support, especially in the form of printed or even copiously illustrated reports and books, however widely circulated, will effect very rapid changes in the industrial processes of India. More could perhaps be done by the active practical work in India of half-a-dozen men of the same stamp as Sir Thomas Wardle, than by the issue of many publications. Let us hope that such men will arise amongst Indians themselves. Such men will find that a commercial and artistic career presents far more advantages than the present and more popular one, which leads only to official employment or even employment at the bar or in medicine and the like.

Sir Thomas Wardle investigated the subjects of Sericiculture and dyeing in India in 1885 and again at a later date.

In accordance with the instructions of Sir G. C. Buck, Secretary of Revenue and Agriculture, he visited the Bengal Sericicultural districts where the Bengal silk of commerce is produced, (the silk of the Bombyx fortunatus and Bombyx Crœsi). He was to report on the causes of their depressed condition and diminished output. This report was published by the department of Revenue and Agriculture and the following is a summary of his results. In some filatures he found very defective reeling, in all possibilities of improvement. In the cocoon-rearing villages there was much preventible disease, and generally about 60 per cent of the worms died from pebrine and other diseases.

The Indian women reeled and wound the silk in a dirty, toilsome and unhealthy way, as may be judged from the illustrations.

The introduction of such an appliance as the Tavelette Keller could remedy the defect of bad reeling.

Other difficulties, which were fully mentioned in the report, could be easily ameliorated by an Imperial bacteriological and educational effort, which he urged.

Mother and daughter: the daughter winding Burni or Weft from the hand-reel to small Shuttle Spools or Squills. (*Fig.* 31)

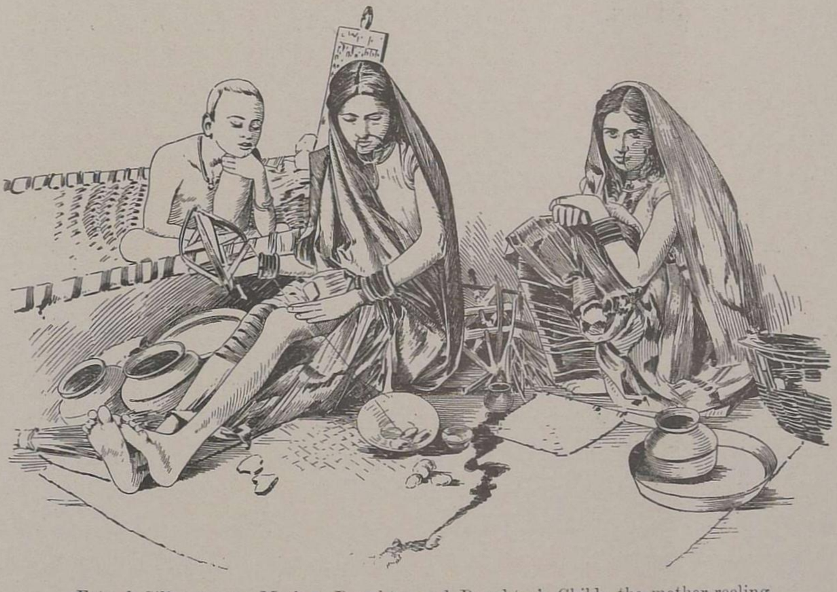
A station was afterwards established at Berhampur, which was directed by Mr. Nityal Gopal Mukharji, who was first sent to the Government Sericicultural establishments of Montpelier and Padua, after having studied the treatment of the various diseases at Paris under M. Pasteur. Much improvement in reeling was effected and the value of Bengal silk increased by upwards of three shillings per lb.

The compiler of this paper who in 1899 accompanied the late Sir John Woodburn, at the time Lieutenant Governor of Bengal, saw the work of the silk department in full and careful operation. He was most struck perhaps by the way in which the silkworms' eggs were all systematically examined with the microscope for the detection of disease.

Sir T. Wardle next went to the Santhal country in Central Bengal to enquire into the output of Tasar silk.

The Santals instead of cutting the pedicles of the cocoons and allowing the latter to drop, cut off the twigs with the cocoons, thus causing the trees to die. He showed the people how wasteful this procedure was and they promised reform. He found hundreds of square miles of forest in which abound the principal trees on which the Tasar moth feeds, and saw almost endless prospects of increasing the production of the valuable insects.

It appeared to him indeed that in India there was vastly more area for the cultivation of silk than for cotton, and he argued that so great was the demand for the former, a demand which was met chiefly by China, that it would be most desirable to meet it. The Rev. Mr. Campbell, with whom he stayed and who worked as a Missionary amongst the Santhalis was of opinion that the best plan to promote increased Tasar culture would be for some capitalist to take the forests and employ the people to collect the cocoons, conditionally that they did not lop the trees.



Fatwah Silk-women: Mother, Daughter and Daughter's Child; the mother reeling Tasar Cocoons. (*Fig.* 30)

He visited Gaya, Arrah and Fatwah, other centres of the Industry.

At Fatwah he saw the local weavers who were weaving cloths of Tasar silk warp and cotton weft. Here also were cocoon merchants who collected Tasar cocoons from the jungle villages and either sold them to reelers or employed women to reel them.

# USES OF TASAR SILK.

THIS is not the place to record all the uses to which the ordinary silk of commerce is put, nor therefore to dwell upon the varieties of it which come from Bengal, but some account of the utilizations of Tasar silk, as summed up by Sir T. Wardle in his paper of June 12th, 1891, seems desirable. He drew particular attention to the beautiful pile fabrics, seal-floss, seal-cloth and sealette, of which he exhibited specimens, and which had been manufactured by Messrs. Norton Brothers & Co., Messrs. Joseph Walker & Sons, and Messrs. Field & Bottrill of Huddersfield and the neighbourhood. He said that nothing in any fibre had ever been made to exceed them, and that they were wonderfully rich, soft, and glossy.

## TASAR EMBROIDERY SILK.

Tasar silk is more lustrous than Japan silk, but is not quite so lustrous as China silk. One of its successful uses is for embroidery. This applied use was first made by Mrs. (afterwards Lady) Wardle, under whose auspices many beautiful specimens have been worked by the Leek Embroidery Society. Many beautiful Indian designs have been reproduced at Leek by the Society with silks dyed with Indian dyes by Sir T. Wardle.

Tapestry Cloths and Curtain Stuffs.—Tasar silk has been successfully substituted for ordinary silks for upholstery cloths or tapestry, as it is erroneously called.

Trimming Materials.—Sir T. Wardle remarked that Tasar silk was superior to other silks for trimming purposes by reason of its natural lustre, cheapness, and greater resistance and firmness of pile. It is also used with success for silk handkerchiefs, dress silks, and damasks.

Carpets and Rugs.—Mr. William Morris designed and his firm made a hand-made carpet for him which was quite as lustrous as the Indian silk carpets, and had a better and firmer pile.

## VELVETS, CURTAINS, AND SHAWLS.

Tasar is admirably suited for furniture velvet. It is more lustrous than Utrecht velvet, but not so soft as ordinary velvet.

Indian Tasar Silk.—This silk finds its greatest market and manufacturing use in France. China Raw Tasar silk is so badly reeled as to be fit only for the coarsest textiles, but since Sir T. Wardle was in India so much attention had been paid to the reeling of the Berhampore and Sardal and some other filatures that Indian raw silk can now be used successfully for artistic purposes by the best Lyonese manufacturers. He comments on their charming brocades, in which Tasar is used for the weft and cotton for the warp.

## OPERA SHAWLS, LACE, AND ELASTIC WEBS OF TASAR IN ENGLAND, GERMANY, ETC.

Sir Thomas Wardle exhibited a large series of examples of printing upon native woven Indian Tasar silk to show what could be done with tinctorial matter, and in further proof of its value in this respect his son had dyed fourteen specimens to the shades of the principal precious stones. He was able to prove with these and the work of other dyers, both English and Continental, that the difficulties of dyeing Tasar silk had been entirely overcome.

The most recent information regarding the production of wild and cultivated silks in the British Colonies and Dependencies is probably contained in No. 2, Vol. VII., of the "Bulletin of the Imperial Institute." The writer refers to the attention which is being paid to the subject, notably in Uganda, British East Africa, and Ceylon, whilst in India steps are being taken to improve the methods of Tasar silkworm rearing. The last-mentioned industry being of considerable interest, he proceeds to give a short account of it, and especially of the improvements introduced recently.

The reader is referred to the "Bulletin" for full information, much of which, however, has already been given from other sources in the present article. The writer of the paper goes on to state, however, that: "From time to time the Bengal Government have endeavoured to foster the rearing of the Tasar silkworm, but in spite of this the industry has steadily declined in the Province. Sir George Watt has ascribed this decline to the successful supply by China of a cocoon suitable for the same purpose as Tasar, and to the cheaper manufactures of Europe. Recently, however, the Bengal Department of Agriculture decided to inaugurate Tasar silkworm-rearing experiments on model farms, and an account of the results obtained is given by the Deputy Director of Agriculture, Bengal, in a recent issue of the 'Indian Agriculturist.'"

These extracts from the "Bulletin" show the continued anxiety of the Bengal Government to develop the silk industry, and it is to be hoped that in the end the hopes of Sir Thomas Wardle himself may be fully realized.

In the introduction to his "Report on Dyes and Tans of India," which was published as a Blue Book in 1887 by the Government of India, Sir T. Wardle wrote as follows:—"The coloured results which form the illustrations to this examination will suffice, however, to show how rich India is in her dyes. I cannot help thinking that it is a misfortune that in publishing these results the Government of India cannot see its way to the expense of publishing coloured illustrations. Without them it is impossible to form an adequate conception of the beauty of the colours obtained, or of the peculiarity of the tones which, under certain methods, so many of them yield.

"I have no hesitation in affirming that these Indian dyes are well worth the attention of European dyers and printers as possessing properties distinct from, and in many cases superior to, the dyes obtained from artificial sources."

Reproduction of the coloured illustrations would not only have been very costly, but even with the best and most expensive methods known the results might have been misleading, because if exposed to light, and in some cases without that being done, in the course of years modern printing colours and tones change, sometimes very considerably, even in book illustration.

In this connection it seems of interest to show what has happened in Calcutta to some of Sir T. Wardle's own illustrations, of which 354 cards (each containing about ten specimens of coloured cotton, wool, silk, Eria and Tasar silk thread, or sample of dyed cloth) were placed in the Bengal Economic Museum under the instructions of the Government of India, when the report was issued about twenty-two years ago.

The "Agricultural Ledger," 1908, No. 2 (1909), is mainly devoted to "A Summary of our present Knowledge regarding the use of Dyes from Flowers in India," by I. H. Burkill. Mr. Burkill states that he has recently examined all Sir T. Wardle's samples which were placed in the Museum in 1886. He compared the present colours with Sir T. Wardle's descriptions. He remarks as follows:—"Most of the specimens have not been exposed to light, but have been left in large folios just as received; though others, since 1899 or 1900, have been exhibited in the diffuse but good light of the Economic Gallery of the Indian Museum . . . . Out of the long series which has not been exposed to light, tissues of Corah silk, Tasar, wool, and cotton dyed with Nyctanthes and Tūn (Cedrela Toona) flowers have faded much, often completely so . . . . Changes in other dyes are not generally detectable, but some deadening of the brilliance is to be expected in almost all. However, a sample of Corah silk dyed with Delphinium Zalil by one of Sir Thomas Wardle's processes, is still of brightness hardly to be excelled . . . . The samples which have been exposed to light are from three dyes only: Butea, Safflower, and Woodfordia. Butea shows some sign of fading in Corah silk and Tasar, but not much . . . . The duller colours of Woodfordia are perhaps a little faster to light; very few of the specimens in the Indian Museum show distinctly that they have faded . . . . The colours of Safflower have all faded more or less. The dye is of course known to be fugitive."

## LIST OF ILLUSTRATIONS.

1, 2, 3. Moths, Cocoons, etc., (in colours). 4, 5. Silk Embroidery (in colours). 9. Silk Embroidery. 7, 8. Tasar Silk: Tapestries, Brocades and Fabrics. 9. Designs for Silk Fabrics. 10. Edward Street House and Swainsley. 11. Portrait of Major General H.H. Sir Pratap Singh, G.C.S.I., and his brother the late General, Raja, Sir Amar Singh, K.C.S.I., and palace at Srinagar. 12, 13 & 14. Illustrations of Silk Production, Filatures, Hibernation Houses, etc.

The coloured plates of Moths were copied by kind permission of the authorities, from specimens in the Natural History Museum at South Kensington. The textiles were copied from originals supplied by the Trustees of the late Sir Thomas Wardle, who were also good enough to allow the remaining illustrations to be reproduced from original works of Sir T. Wardle.

I.—1. Bombyx Mori. (*a*) Cocoon cut open. (*b*) Cocoon. (*c*) Eggs. (*d*) Pupa. (*e*, *f*) Cocoons denuded of rough exterior silk. (*g*) Skein of silk. (*h*, *j*, *k*, *e*) Moths. (*m*, *m*) Larvæ, or worms. 2. Antherœa Mylitta or Tasar Moth. (*a*) Male. (*b*) Female. (*c*, *d*) Tasar cocoons with their pedicles, showing natural attachment to branches. (*e*) Cocoon.

**2.**– **1.** Attacus Ricini. (*a*) Male. (*b*) Female. (*c, d, e, f*) Cocoons. 2. Antherœa Assama or Muga Moth. (*a*) Male. (*b*) Female. (*c, d*) Cocoons.

From the Natural History Museum, South Kensington. By permission.

3.—Attacus Atlas. (*a*) Male. (*b*) Female. (*c*) Pupa. (*d*, *e*) Cocoons.

4.—"Indian Poppy."

A well-known Leek design.

5.—"Damascus."

Design worked in Tasar Silk at the Leek Embroidery School.

**6.**—Design from a Fresco in the ancient Buddhist caves at Ajanta, Bombay Presidency. One of a series of beautiful designs taken from the caves by Sir T. Wardle. The best date, about the first or second Century, A.D.

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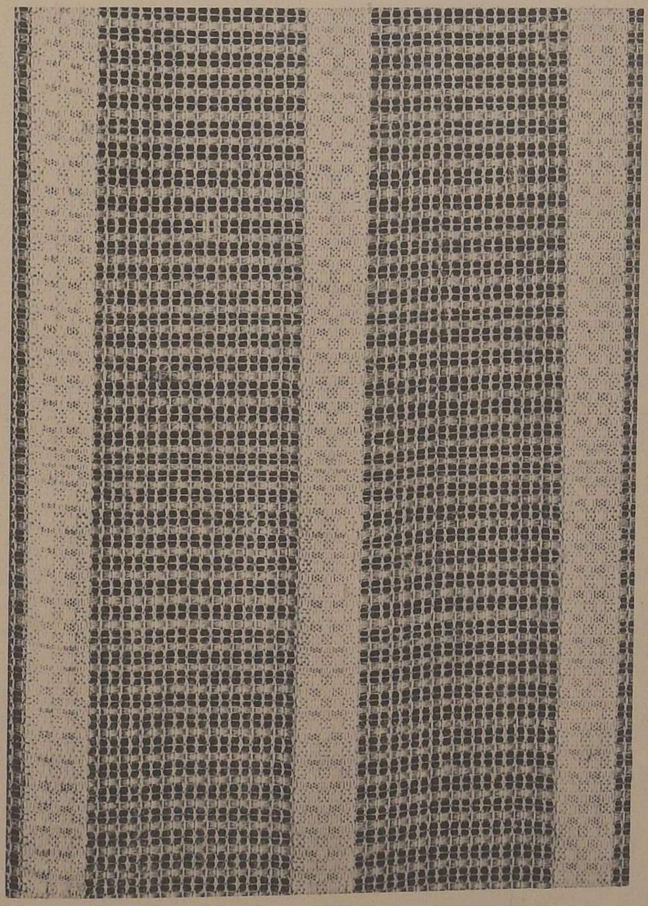

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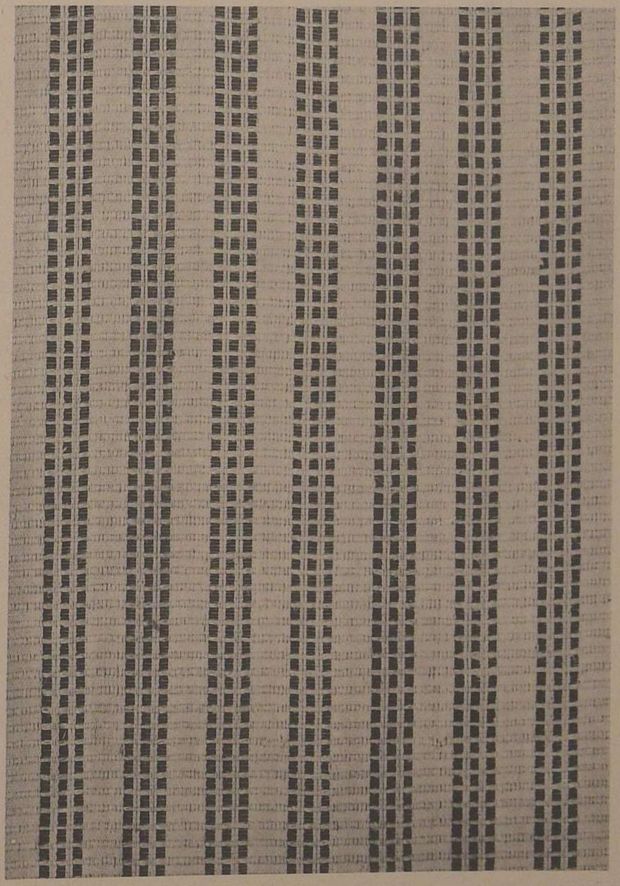

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7.—1. Figured tapestry, woven with Tasar silk; "Indian Bombyx Mori." 2. Figured tapestry, Tasar silk. 3. Natural Tasar silk, woven fabric. 4. Natural Tasar silk, woven fabric.

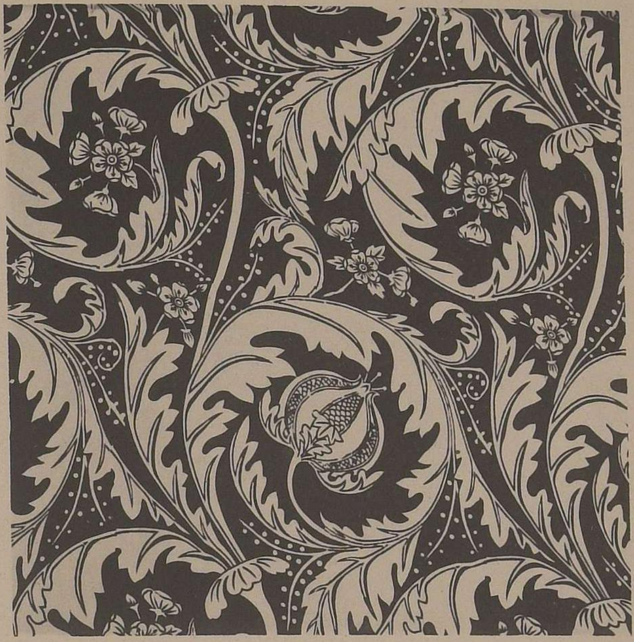
1

2

3

4

8.—1. Silk Brocade, woven part Tasar silk. 2. Tapestry, the silk part of this fabric is Tasar Silk; the principal wild silk of India. 3. Tapestry, design worked in Tasar Silk; the woven part of which is Indian Tasar Silk. 4. Silk Brocade, the woven part Tasar Silk.



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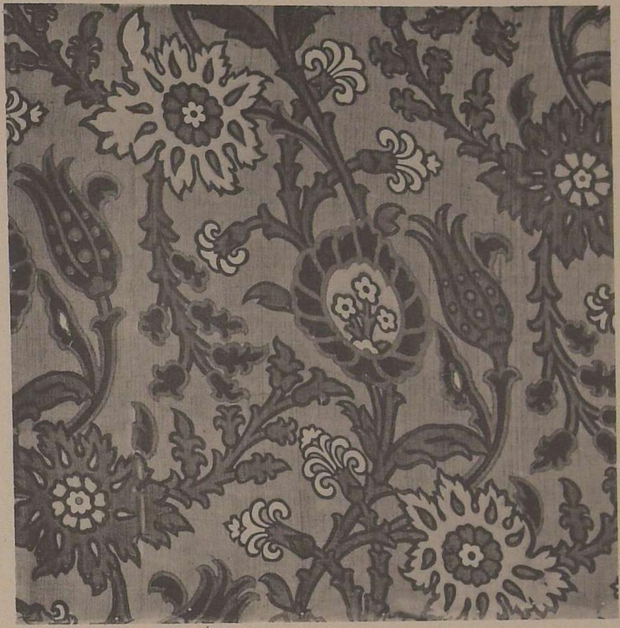

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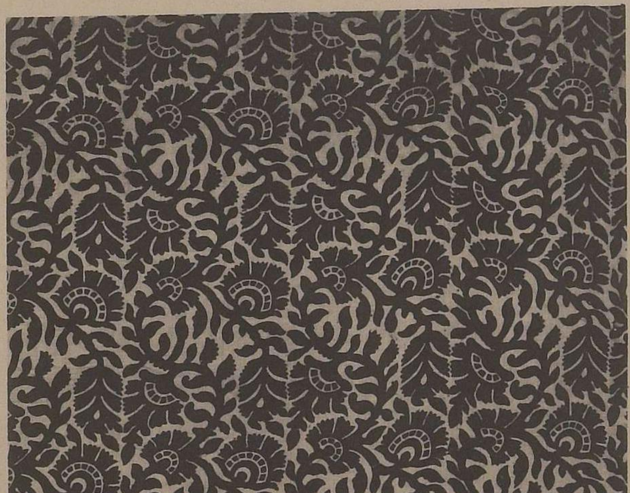

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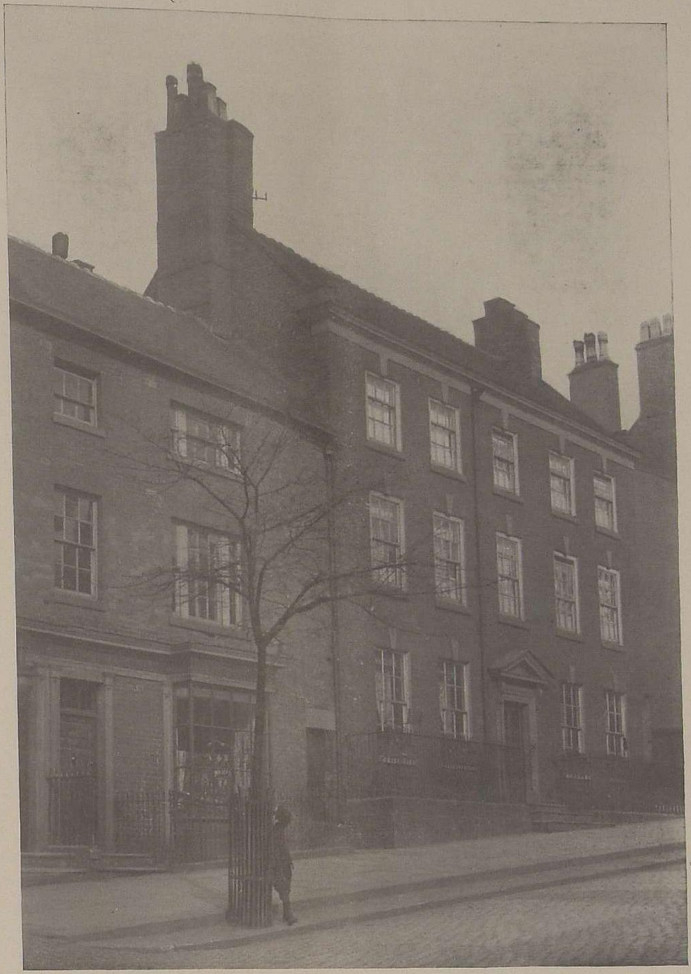
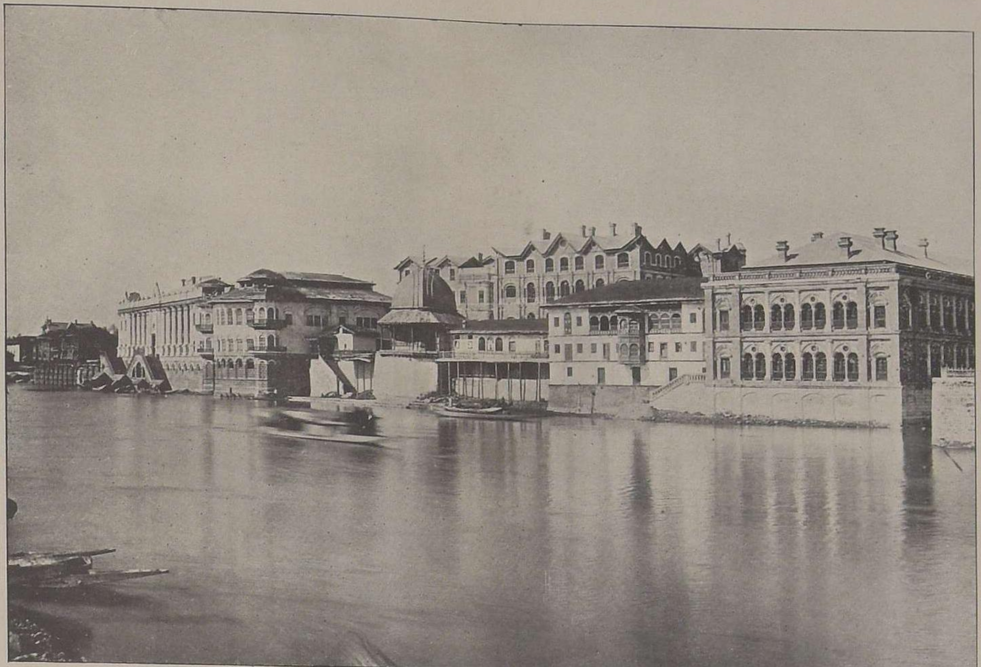
9.—Designs for silk fabrics, such as velveteens for example. I. Pomegranate. 2. Damascus pattern. 3. Ambra design, (derived from the Mango ?). 4. Kharita design, (probably derived from a common ornament of brocade bags used for state letters.



Sir Thomas Wardle's House, St. Edward Street, Leek.
The smaller house is the Leek Embroidery School.

Swainsley.—The country home of Sir Thomas Wardle, on the Manifold River, Staffordshire.

Plate 10.

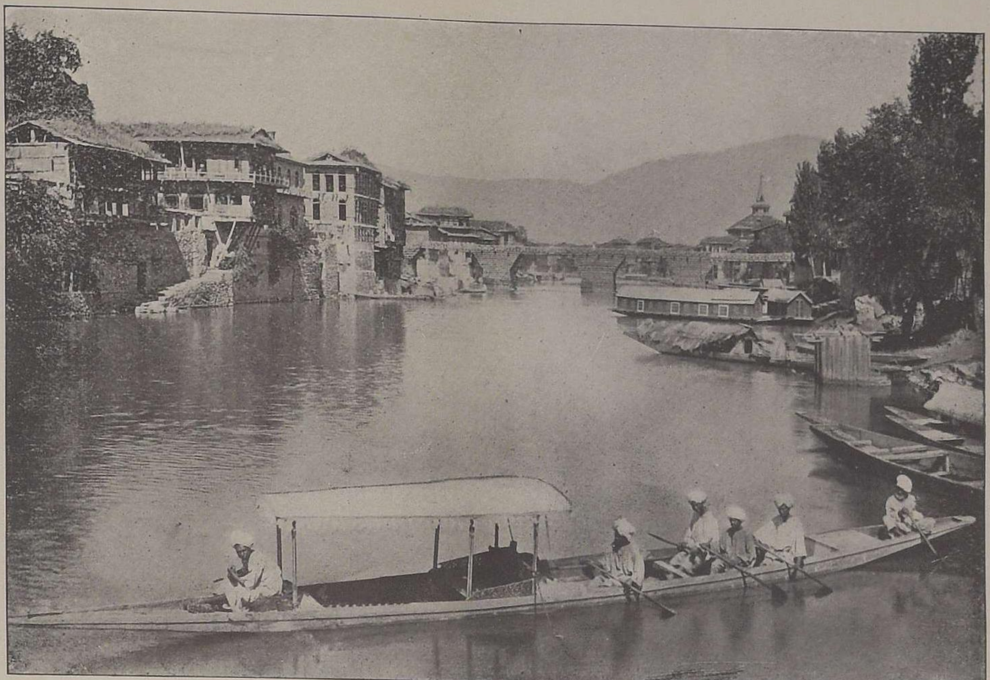


1. Palace of H.H. The Maharaja of Jamu and Kashmir on the Jhelum at Srinagar, Kashmir.

2. Major General H.H. Sir Pratap Singh, G.C.S.I., Maharaja of Jamu and Kashmir.

3. The late General, Raja, Sir Amar Singh, K.C.S.I., brother of H.H. The Maharaja of Jamu and Kashmir.

Plate 11.

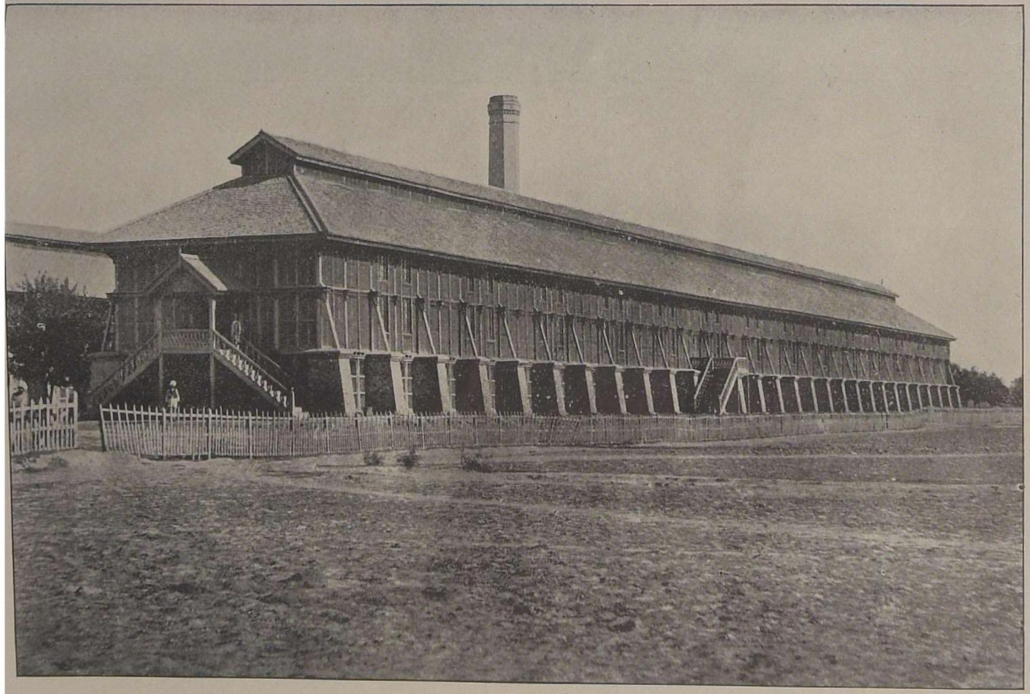


1. Third bridge and Srinagar city; showing the Mohamedan Mosque, Shah Hamadān in the distance.

2. A Jhelum steering boat girl with the customary heart-shaped oar.

3. Hindu woman of Srinagar carrying water.

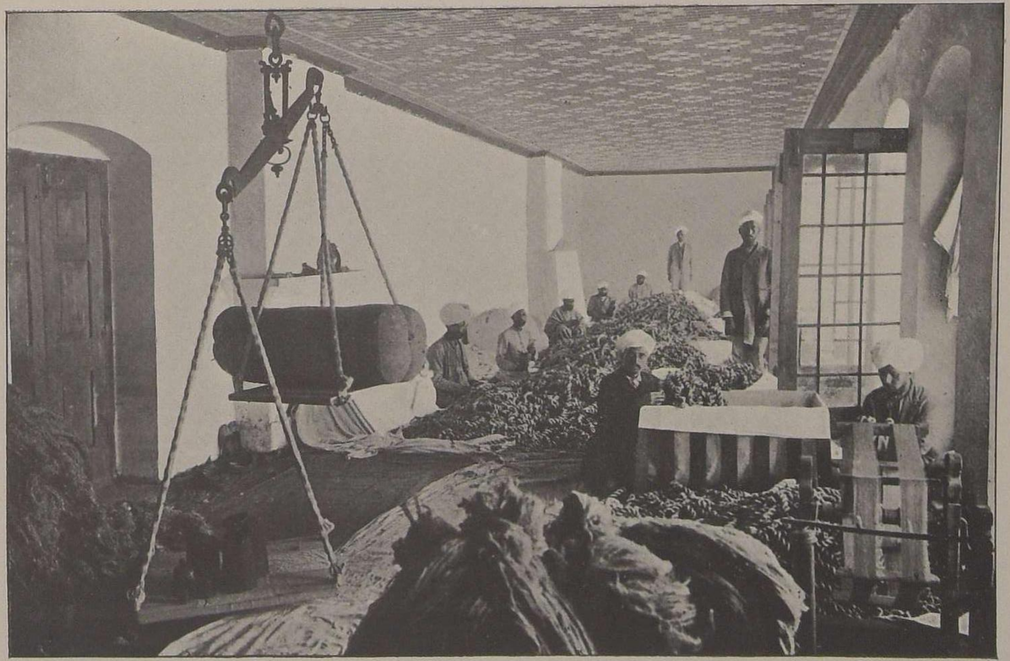
Plate 12.



1. Srinagar Silk Filature. Length 435 feet, width 42 feet, containing 550 workers.

2. Interior of Filature in operation.

3. View showing the ends of Six of the Ten Cocoon-Reeling Filatures at Srinagar.



4. Baleing Room of the Srinagar Filatures.

1. Two Hibernation Houses for Silk-worm Eggs.

2. A group of Mulberry Trees near the Filatures at Srinagar.

3. Baramula, on the Jhelum, entrance into the valley of Kashmir, 30 miles from Srinagar.

4. View of the terraced agricultural operations between Srinagar and Islamabad.

Plate 14.

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